Birds Banded in the Riverina between 1964 and 1972, with an examination of numbers caught over time at Narrandera

L. C. Llewellyn

Curlew Biological Services, PO Box 67, Pacific Palms, NSW 2428

Email: leighton@activ8.net.au

ABSTRACT

A total of 5618 birds (118 species) were banded in the Riverina between 1964 and 1972. A total of 3139 of these (95 species) were banded at the Inland Fisheries Research Station (IFRS) (now the Narrandera Fisheries Centre) on 629 days netting**.** At the IFRS 608 individual birds were recaptured a total of 922 times, giving a recovery rate of 19.4%. Residency, migration, irregularity of visits and the influence that rainfall and flooding played on these were examined. Birds banded elsewhere in the Riverina are recorded and the incidence of breeding is reported. The need for long term studies to determine true species diversity in inland Australia is emphasised.

Key words: Bird banding Riverina, Bird banding Narrandera, bird numbers over time 1964 -1972, resident, migratory and irregular visitors.

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Introduction

This paper reports results from a comprehensive bird study in the Riverina from February 1964 to January 1972. Banding commenced in August 1964 and the principal banding site was the Inland Fisheries Research Station (IFRS) (34°47'S 146°34'E) now known as the Narrandera Fisheries Centre, which is located at Narrandera on the eastern edge of the Riverina in New South Wales (Fig. 1). Trapping and banding was carried out opportunistically at other sites throughout the Riverina (See Fig. 2 for extent of Riverina). General observations were recorded of the occurrence of birds in the area over the 8 year period. A majority of the banding at the IFRS was done using mist nets. Netting at this site was carried out frequently, but not to a set schedule. The frequency of netting reduced towards the end of the period. The main aim of this paper is to document the species banded at the IFRS and to analyse the pattern of occurrence of these species.

Methods

Study sites

IFRS

Narrandera is situated on the Murrumbidgee River on the eastern edge of the Hay plains which is a semi arid area consisting mainly of Boree-Saltbush alliance. The IFRS lies 4km to the east of the Narrandera township adjacent to the southern side of the Murrumbidgee River and its associated floodplain. The river is lined with River Red Gum *Eucalyptus camaldulensis* plant alliance. Yellow box *Eucalyptus melliodora*, Grey (Inland) Box *E. microcarpa* (includes *E. woolsiana* Brooker and Kleinig (1999)) and occasional Bulloak *Allocasuarina luehmannii* occur adjacent to the *E. camaldulensis*. Birds occurring on the Research Station are particularly influenced by the adjacent plains, Murrumbidgee River and associated plant Alliances. In addition, the IFRS is particularly attractive to birds, because at the time, it had 29 ponds on the site which were full of water most of the time, both during summer and winter, and during droughts. The Station had also been planted extensively with trees, particularly profusely flowering trees such as Queensland Silver Wattle *Acacia podalyriifolia,* Cootamundra Wattle *A. baileyana*, Golden Wattle *A. saligna*, Lemon – Flowered Gum *Eucalyptus woodwardii*, *E. melliodora,* Lemon Scented Gum *E. citriodora*, Red Ironbark *E. sideroxylon*, *E. camaldulensis,* Athol Tree *Tamarix aphylla*, Oaks *Casuarina* sp. and Boobialla *Myoporum* sp. (taxonomy Harden 1990), all of which provided good cover and a rich source of food for birds (see Figs 3,4). Much of the central area of the station was kept watered by a high pressure overhead water system that kept the area green even during drought.

Other sites

A range of sites was chosen to target birds using different habitats. A mist netting site in Gillenbah State Forest (SF) 34°48'S 146°28'E (Fig. 2, 6) was used on 12 occasions between 1965 and 1967. It was around a dam in a White Cypress Pine forest *Callitris glaucophylla*. At the time Superb Parrots *Polytelis swainsonii* were targeted as they moved through the area. A second site was Dixon's Dam (34°50'S 146°38'E) (Fig. 2, 4) a backed up creek line surrounded by inundated *E. camaldulsnsis* during floods.

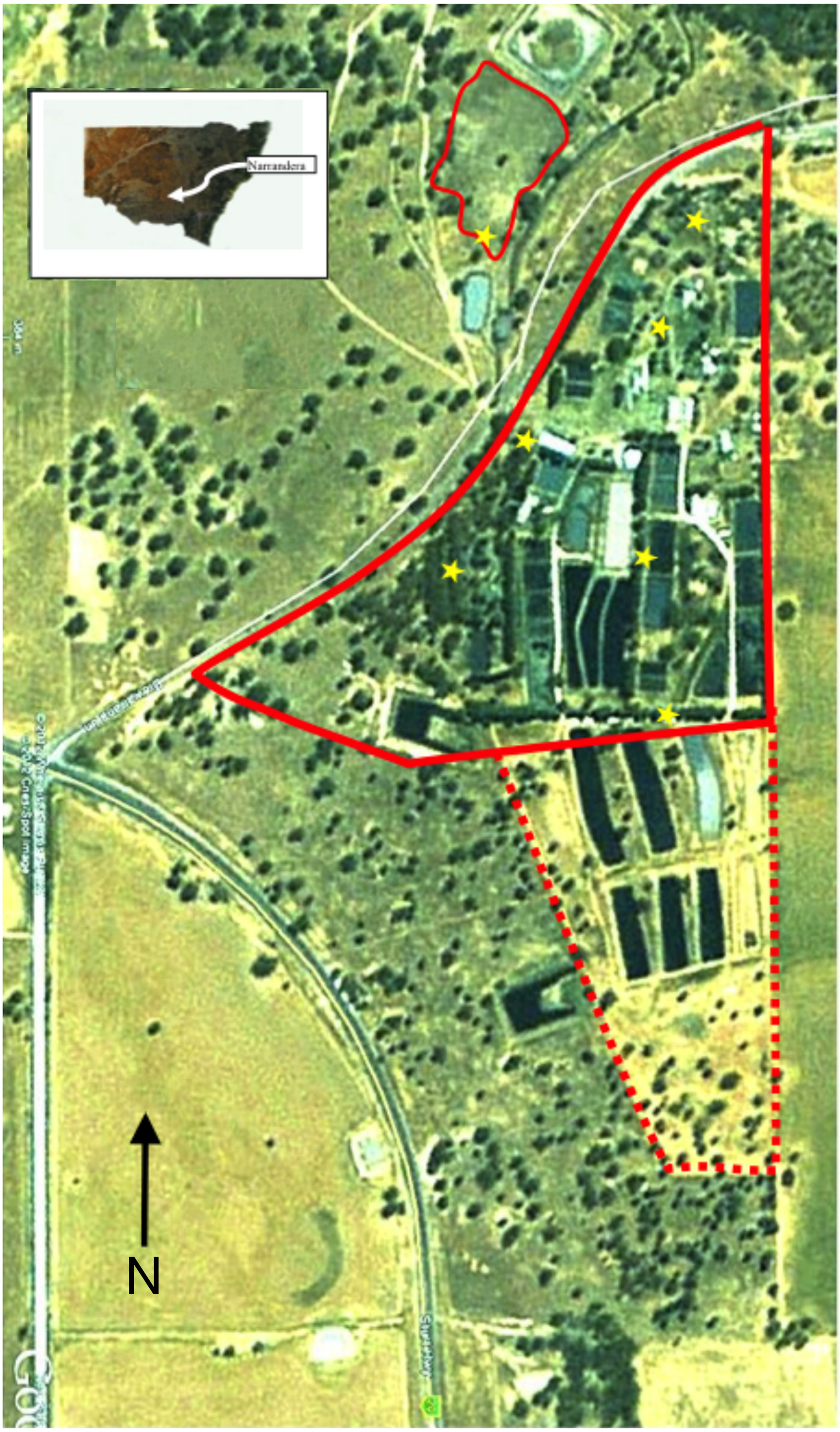

Fig. 1 Satellite image of Inland Fisheries Research Station, Narrandera (Google Earth 2012) showing sites where banding took place (yellow stars). Note the extension to the Research Station and many new ponds both inside and outside the old confines of the Research Station. ▬▬ Station boundary until 1972. - - - - - Extension to Station boundary post 1972. —— Newly formed swamp boundary.

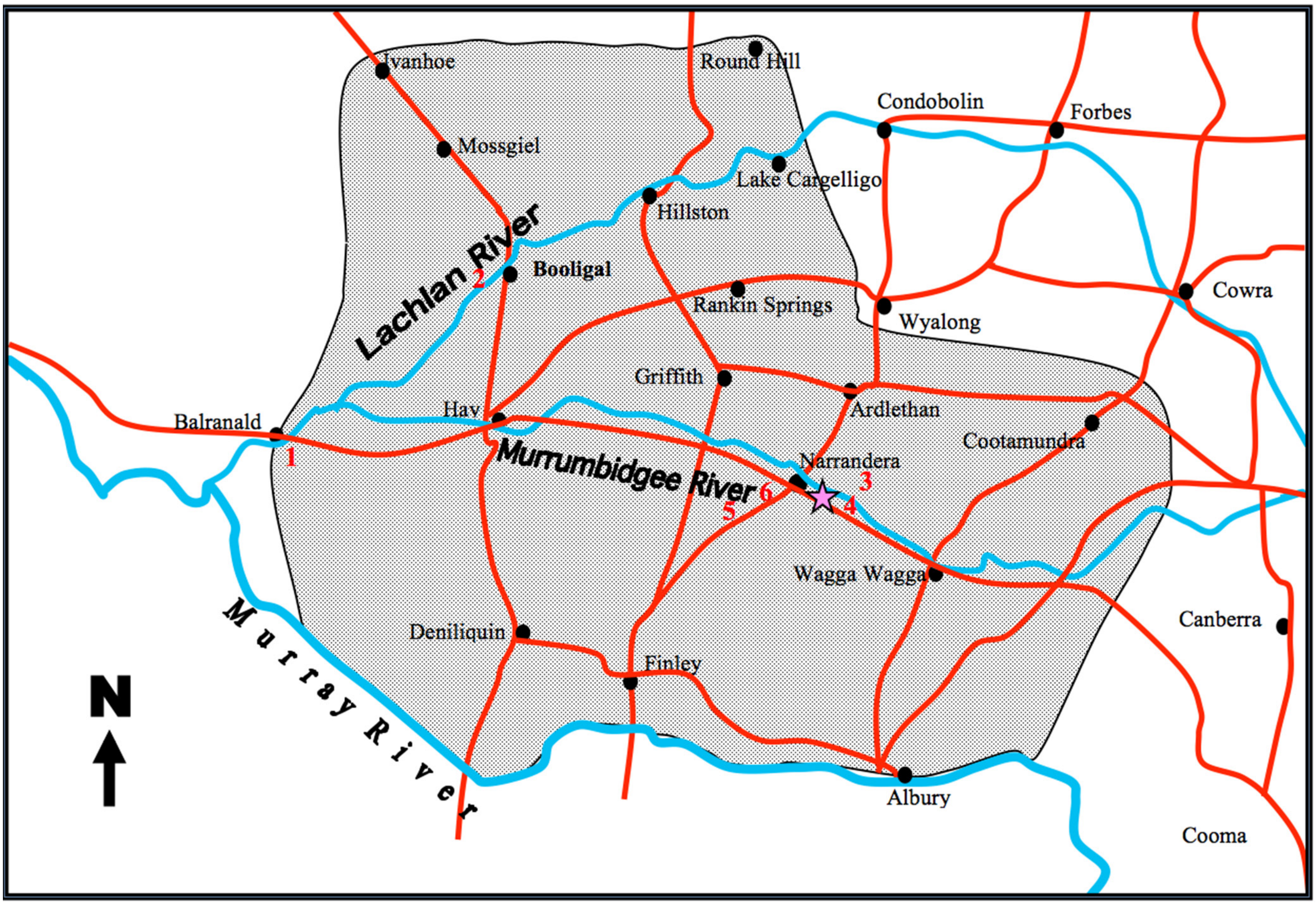

Fig. 2. The extent of the Riverina used in this study (stippled). ★ Location of Inland Fisheries Research Station. ▬ Roads. ▬ Rivers. **1**, Yanga Lake, Balranald; **2**, Muggabah Creek, Booligal; **3**, Grong Grong; **4**, Dixon's Dam, Narrandera; **5**, Aloe Hill, Morundah; **6**, Gillenbah State Forest.

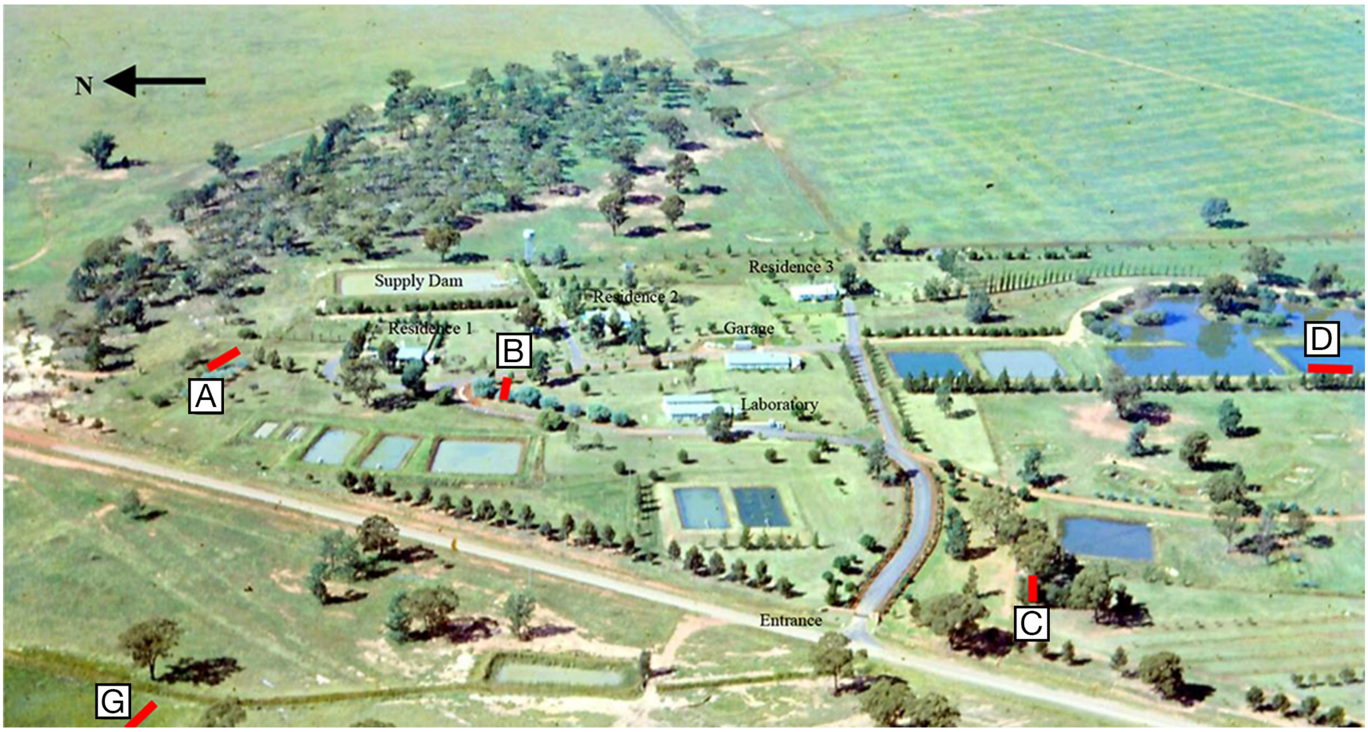

Fig. 3. Aerial photograph of Inland Fisheries Research Station in June 1969 showing five banding stations A-D and G in the northern two thirds of block.

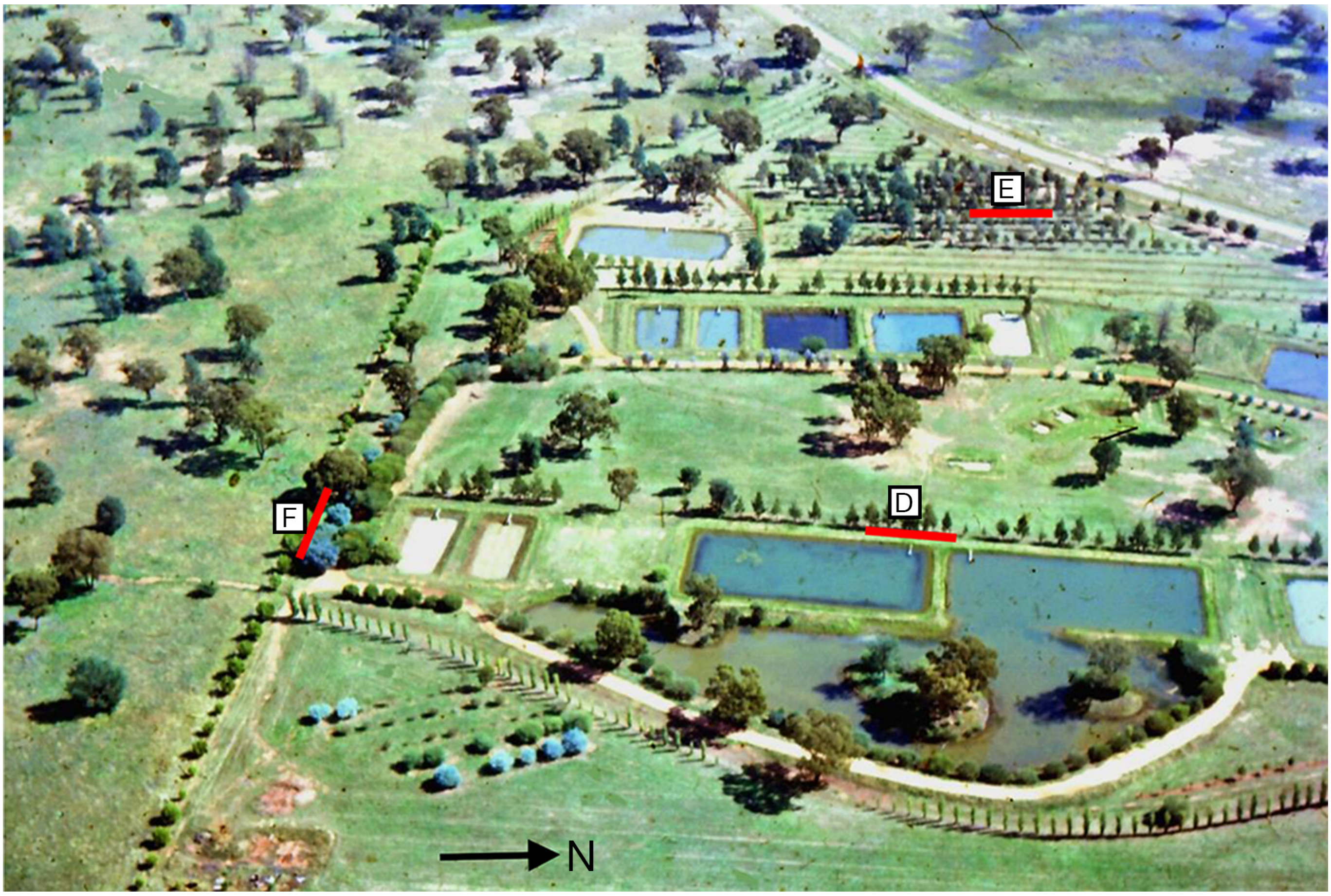

Fig. 4. Aerial view of Inland Fisheries Research Station around 1972 showing 3 mist netting sites D, E and F in the southern end of the block.

This site was used to band wetland birds when they were breeding. A third site at Grong Grong (34°43'S 146°50'E) (Fig. 2. 3) close to a small grain silo was used to capture Galahs *Eolophus roseicapillus* for experimental band purposes. In addition banding was carried out at a major ibis colony on a Lignum *Muehlenbeckia florulenta* wetland on Muggabah Creek, Booligal (33°52'S 144°49'E) (Fig. 2. 2), banding of grassland species was targeted on Aloe Hill a property near Morundah (35°00'S 146°13'E) (Fig. 2. 5), and Yanga Lake near Balranald (34°41'S 143°38'E) (Fig. 2. 1) was visited to capture Black Swans *Cygnus atratus*. A vertical clay bank on the Murrrumbidgee River near the IFRS was visited to band White-backed Swallows *Cheramoeca leucosterna* and Fairy Martins *Petrochelidon ariel*. Opportunistic trapping of raptorial birds was carried out throughout the Riverina area, generally targeting birds on roadside telegraph poles.

Trapping methods

At the principal banding location at the IFRS mist nets were used. On a few occasions a drop trap was used to target ground feeding species such as Red-rumped Parrots *Psephotus haematonotus* and Peaceful Doves *Geopelia striata*. Mist nets used were 32mm (1.25") diagonal mesh, 3 shelf, and 9.2 and 12.2m (30 and 40') long. They were set between poles 0.6 to 2.7m (2 – 9') high and were placed along and between rows of trees or vegetation, particularly wattles. Nets were particularly effective when placed adjacent to a dripping water tap. They were normally unfurled at first light and closed down at around 8.45am. Occasionally they were reopened at around 5.30 pm to dusk. All birds caught were identified, sexed where possible, banded and recorded, and re-trapped birds were recorded also. Four nets were used on most occasions at sites A,B,C (Fig. 3) and F (Fig. 4). The sites at D and E (Fig. 4) were used less frequently, and the site at G (Fig. 3) was only used from 1969 to 1972 when the swamp had become established from overflow of the outlet channel from the Research Station. Mist nets were also used at the Gillenbah SF site around a dam.

Other trapping methods used outside the research station throughout the Riverina were Bal Chatri traps using white mice and white pigeons, a snare pole with crook or snare for capturing particularly young parrots just out of the nest or young cormorants and their nestlings or other tree nesting water-birds in trees out of normal reach, a hoop or throw net that could be deployed from the back of a utility while spotlighting at night in cleared paddocks for ground birds such as quail, Plains-wanderer *Pedionomus torquatus* and other grassland birds, corralling by running a temporary fence around a patch of vegetation in a major ibis colony so that birds could be banded and quickly released, and hoop nets of various sizes that could be placed or staked over nesting burrows or hollows used by birds such as *Cheramoeca leucosterna* or Rainbow Bee-eaters *Merops ornatus*, or across culverts in which *Petrochelidon ariel* were nesting. At the Grong

Grong site a large drop trap around 6x4m triggered by a pull rope was used. The *Cygnus atratus* on Yanga Lake were caught by chasing flightless birds in a motor boat and capturing them from the side of the boat. The *C. leucosterna* were caught at night in the river bank by staking small nets over the burrows and then shining a torch down the burrow.

Analysis

Data obtained from trapping at the Research Station were examined. The number of birds and species banded per year and the cumulative annual totals were determined. The percent recovered for all species combined and for individual species, the frequency of the numbers of times individuals of a species were recovered, and the frequency of the numbers of days elapsed between banding and recovery particularly for those species in which sufficient recoveries were made, were determined.

The number of birds captured (banded plus times recaptured) in each season was determined for the whole period 1964 to 1972 and for all seasons grouped together. The numbers of each species captured per net day were then calculated for each season. Such analysis reduced the effect on the results of the reduced number of netting days in the latter part of the period. Following examination of the data, species with adequate recoveries were selected to demonstrate their frequency of occurrence, to determine whether they were resident, seasonal visitors or erratic spasmodic visitors. Some comparisons were then made between seasonal occurrence, local rainfall and floods (river heights), however flowering trees or other unknown factors may also be influencing their presence.

The incidence of breeding was reported for those birds banded in the Riverina outside the IFRS.

Results

Banding results

Birds banded in Riverina outside the IFRS

Of the 5638 birds comprising 118 species banded in the Riverina, 2499 comprising 67 species were banded outside the IFRS (Table 1). Significant among the latter were the 1175 Straw-necked Ibis *Threskiornis spinicollis* and 18 Glossy Ibis *Plegadis falcinellus* runners banded at Booligal using a corralling method during a large breeding event. During a series of breeding events at Dixon's Dam, 43 Australasian Darters *Anhinga novaehollandiae*, 334 Little Pied Cormorants *Microcarbo melanoleucos*, 6 Little Black Cormorants *Phalacrocorax sulcirostris*, 10 Great Cormorants *Phalacrocorax carbo*, 71 Australian White Ibis *Threskiornis molucca*, 16 White-necked Heron *Ardea pacifica*, 13 Yellow-billed Spoonbill *Platalea flavipes* and 32 *Cygnus atratus* were banded. At Gillenbah SF no *Polytelis swainsonii* were caught but 57 *Psephotus haematonotus*, 9 Noisy Miners *Manorina melanocephala* and 9 Apostlebirds *Struthidea cinerea* were mist netted. At Grong Grong using a large drop trap 114 *Eolophus roseicapilla*, 18 Crested Pigeon *Ocyphaps lophotes* and 9 *Struthidea cinerea* were trapped. At Morundah using a hoop throw net spotlighting at night 184 Stubble Quail *Coturnix pectoralis*, 3 Little Button-quail *Turnix velox*, 9 Brown Song lark *Cinclorhamphus cruralis*, 7 Horsfield's Bushlark *Mirafra javanica*, and 1 *Pedionomus torquatus* were caught. At Yanga Lake 20 flightless young or mature moulting *Cygnus atratus* were caught using a speed boat. At the Murrumbidgee River bank 92 *Petrochelidon ariel* and 10 *Cheramoeca leucosterna* were caught using a small hoop net over the nesting hole and a torch at night. Forty two *Petrochelidon ariel* were caught with a net over culverts at various locations.

Bal Chatri trapping was used at various locations while travelling throughout the Riverina, generally targeting birds sitting on telegraph poles. Thirty one Nankeen Kestrels *Falco cenchroides*, 3 Brown Falcons *Falco berigora*, 1 Brown Goshawk *Accipiter fasciatus*, 1 Black-shouldered Kite *Elanus axillaris*, 16 Laughing Kookaburras, *Dacelo novaeguineae*, 13 Pied Butcherbirds *Cracticus nigrogularis* and 22 Australian Magpies (Black-backed) *Gymnorhina tibicen tibcen* were trapped using this method (Table 1). Of those trapped by means of Bal Chatri traps 36 were birds of prey.

Most other birds captured outside the Research Station were banded in breeding colonies, nestlings in the nest, caught from nest hollows and as runners and were thus recorded as breeding in Table 1. Dates of breeding where known have been included.

Birds banded at IFRS.

A total of 3139 birds of 95 species (Table 1) were banded on the Research Station on 629 days netting (Fig. 5) between 1964 and 1972. The annual cumulative totals of species and number of species banded each year are shown in Figure 6 and the annual cumulative totals of numbers of individual birds and numbers caught each year are shown in Figure 7. Six hundred and eight birds were recaptured, a total of 922 times, giving a total number of captures of 4061 (Table 1). The number of months out of 89 (1964-72) recorded as a percentage, in which each species was recorded is also shown in Table 1. Details of numbers of individual species banded, their recovery and recovery rates are shown in Table.1.

Recoveries

Of the 95 species banded at the Inland Fisheries Research Station 39 were recaptured. Of the 3139 birds banded, 608 were recaptured giving a recovery rate of 19.4%. They were recovered a total of 922 times. The percentage recovery for individual species is shown in Table 1. The highest and most significant recovery rate was for *Geopelia striata* (60% of the 15 banded), Southern Whiteface *Aphelocephala leucopsis* (54.3% of 46), Yellow-rumped Thornbill *Acanthiza chrysorrhoa* (34.4% of 153) and Rufous Whistler *Pachycephala rufiventris* (32.6% of 43). The number of times recaptured is plotted for six species with 25 or more recoveries plus *Geopelia striata* (Fig. 8 a-f). A *Psephotus haematonotus* was recaptured 9 times (Fig 8e), while a White-plumed Honeyeater *Lichenostomus penicillatus* and an *Aphelocephala leucopsis* were recaptured 7 times (Fig. 8a and d). The number

Table 1. Data on birds banded at the Inland Fisheries Research Station and elsewhere in the Riverina between 1964 and 1972 listed alphabetically by common names (according to Christidis and Boles 2008). The recapture data, number of months on which birds are banded, and number banded as young or at nest, and months found breeding are shown.

English name	Binomial name	Banded IFRS	No. Recaptured IFRS	Percentage recaptured at IFRS	No. Times recaptured IFRS	Total no. of captures IFRS	Riverina banded excluding IFRS	Number of months birds banded between 1964 and 1972 in Riverina (n=89)	Percentage of months birds banded between 1964 and 1972 in Riverina (n=89)	Banded at nest or young Riverina excluding IFRS	Month or range of months found breeding	Total banded Riverina including IFRS
Apostlebird	*Struthidea cinerea*						19	5	5.62	8	11,12	19
Australasian Darter	*Anhinga novaehollandiae*						44	5	5.62	44	11,12, 1,2	44
Australasian Grebe	*Tachybaptus novaehollandiae*	5				5		2	2.25			5
Australasian Pipit	*Anthus novaeseelandiae*	1				1	4	2	2.25			5
Australian Hobby	*Falco longipennis*	1				1		1	1.12			1
Australian Magpie (Black-backed)	*Cracticus tibicen tibicen*	20	4	20.0	8	28	22	17	19.10	10	9-11	42
Australian Raven	*Corvus coronoides*	1		0.0		1		1	1.12			1
Australian Reed-Warbler	*Acrocephalus australis*	111	13	11.7	14	125		4	4.49			111
Australian Shelduck	*Tadorna tadornoides*						4	1	1.12	4	10	4
Australian White Ibis	*Threskiornis molucca*		2		2	2	76	5	5.62	76	10-2	76
Australian Wood Duck	*Chenonetta jubata*		1		1	1						
Baillon's Crake	*Porzana pusilla*	4		0.0		4		1	1.12			4
Banded Lapwing	*Vanellus tricolor*						7	4	4.49	7	9,10-12	7
Black Swan	*Cygnus atratus*						32	5	5.62	32	10-12	32
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	1		0.0		1	2	2	2.25			3
Black-faced Woodswallow	*Artamus cinereus*											
Black-fronted Dotterel	*Elseyornis melanops*	2		0.0		2	6	5	5.62	3	11-1	8
Black-shouldered Kite	*Elanus axillaris*						1	1	1.12			1
Blue Bonnet	*Northiella haematogaster*	1		0.0		1	5	3	3.37			6
Blue-faced Honeyeater	*Entomyzon cyanotis*	3		0.0		3		4	4.49			3
Brown Falcon	*Falco berigora*	1		0.0		1	3	4	4.49			4
Brown Goshawk	*Accipiter fasciatus*	1		0.0		1	1	1	1.12			2
Brown Songlark	*Cincloramphus cruralis*						9	1	1.12			9
Brown Treecreeper	*Climacteris picumnus*	1		0.0		1	3	4	4.49			4
Brown-headed Honeyeater	*Melithreptus brevirostris*	20	4	20.0	4	24	2	7	7.87			22
Budgerigar	*Melopsittacus undulatus*						1	1	1.12			1

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Chestnut-rumped Thornbill	*Acanthiza uropygialis*	3	1	33.3	2	5		3	3.37			3
Cockatiel	*Nymphicus hollandicus*	1		0.0		1	2	2	2.25	2	11	3
Common Blackbird	*Turdus merula*	1		0.0		1		1	1.12			1
Common Bronzewing	*Phaps chalcoptera*	1		0.0		1	1	2	2.25			2
Common Starling	*Sturnus vulgaris*	75	1	1.3	1	76	1	13	14.61			76
Crested Pigeon	*Ocyphaps lophotes*	11	1	9.1	1	12	21	11	12.36			32
Crested Shrike-tit	*Falcunculus frontatus*	2		0.0		2		2	2.25			2
Crimson Rosella (Yellow)	*Platycercus elegans flaveolus*	38	2	5.3	2	40	4	19	21.35			42
Diamond Firetail	*Stagonopleura guttata*	25	6	24.0	7	32		11	12.36			25
Dusky Woodswallow	*Artamus cyanopterus*						1	1	1.12			1
Eastern Great Egret	*Ardea modesta*						1	1	1.12	1	2	1
Eastern Rosella	*Platycercus eximius*	12	2	16.7	3	15	1	9	10.11	1	1	13
Eastern Yellow Robin	*Eopsaltria australis*	1		0.0		1		1	1.12			1
Eurasian Coot	*Fulica atra*						2	1	1.12			2
European Goldfinch	*Carduelis carduelis*	65	1	1.5	1	66		11	12.36			65
Fairy Martin	*Petrochelidon ariel*	12		0.0		12	134	10	11.24	134	9-12	146
Flame Robin	*Petroica phoenicea*	17		0.0		17		5	5.62			17
Galah	*Eolophus roseicapillus*	3		0.0		3	113	10	11.24	22	10-12	116
Glossy Ibis	*Plegadis falcinellus*						18	1	1.12	18	12	18
Golden Whistler	*Pachycephala pectoralis*	9	3	33.3	3	12		8	8.99			9
Great Cormorant	*Phalacrocorax carbo*						9	2	2.25	9	10-1	9
Grey Butcherbird	*Cracticus torquatus*	1		0.0		1		2	2.25			1
Grey Fantail	*Rhipidura albiscapa (fuliginosa)*	20		0.0		20		8	8.99			20
Grey Shrike-thrush	*Colluricincla harmonica*	13	5	38.5	8	21		12	13.48			13
Grey Teal	*Anas gracilis*	5		0.0		5	4	2	2.25	4	12-1	9
Grey-crowned Babbler	*Pomatostomus temporalis*	7		0.0		7	2	4	4.49			9
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	2		0.0		2		2	2.25			2
Horsfield's Bushlark	*Mirafra javanica*						7	1	1.12			7
House Sparrow	*Passer domesticus*	80	15	18.8	22	102	5	21	23.60			85
Jacky Winter	*Microeca fascinans*	4		0.0		4		3	3.37			4
Latham's Snipe	*Gallinago hardwickii*	1		0.0		1		1	1.12			1
Laughing Kookaburra	*Dacelo novaeguineae*	18	3	16.7	5	23	16	15	16.85	2	11	34
Little Black Cormorant	*Phalacrocorax sulcirostris*	1		0.0		1	6	3	3.37	6	12-2	7
Little Button-quail	*Turnix velox*	2		0.0		2	3	2	2.25			5

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Little Eagle	*Hieraaetus morphnoides*	1		0.0		1		1	1.12			1
Little Friarbird	*Philemon citreogularis*	93	9	9.7	10	103	5	18	20.22	5	1	98
Little Grassbird	*Megalurus gramineus*	29	1	3.4	1	30		4	4.49			29
Little Pied Cormorant	*Microcarbo melanoleucos*						329	9	10.11	328	10-2	329
Little Raven	*Corvus mellori*	4		0.0		4		1	1.12			4
Magpie-lark	*Grallina cyanoleuca*	25	3	12.0	4	29	6	14	15.73	4	10	31
Masked Lapwing (Spur-winged Plover)	*Vanellus miles novaehollandiae*	4		0.0		4	1	3	3.37	1	10	5
Mistletoebird	*Dicaeum hirundinaceum*	4	1	25.0	1	5		4	4.49			4
Musk Duck	*Biziura lobata*	4		0.0		4		4	4.49			4
Nankeen Kestrel	*Falco cenchroides*	5		0.0		5	31	11	12.36	6	11-1	36
Noisy Miner	*Manorina melanocephala*	69	5	7.2	5	74	14	15	16.85	9	10-12	83
Pacific Black Duck	*Anas superciliosa*	9	1	11.1	1	10		1	1.12			9
Peaceful Dove	*Geopelia striata*	15	9	60.0	25	40		5	5.62			15
Pied Butcherbird	*Cracticus nigrogularis*	8	3	37.5	4	12	13	12	13.48			21
Pied Currawong	*Strepera graculina*	5		0.0		5		5	5.62			5
Plains-wanderer	*Pedionomus torquatus*						1	1	1.12			1
Rainbow Bee-eater	*Merops ornatus*	4		0.0		4	6	4	4.49	6	12	10
Red-backed Kingfisher	*Todiramphus pyrrhopygius*	1		0.0		1		1	1.12			1
Red-capped Robin	*Petroica goodenovii*	29	10	34.5	16	45		18	20.22			29
Red-chested Button-quail	*Turnix pyrrhothorax*						2	1	1.12			2
Red-kneed Dotterel	*Erythrogonys cinctus*						1	1	1.12			1
Red-rumped Parrot	*Psephotus haematonotus*	101	29	28.7	71	172	65	24	26.97	10	10-11	166
Restless Flycatcher	*Myiagra inquieta*	6		0.0		6		3	3.37			6
Rufous Songlark	*Cincloramphus mathewsi*	1		0.0		1		1	1.12			1
Rufous Whistler	*Pachycephala rufiventris*	43	14	32.6	17	60		18	20.22			43
Sacred Kingfisher	*Todiramphus sanctus*	10	1	10.0	1	11		5	5.62			10
Scarlet Robin	*Petroica boodang*	1		0.0		1		1	1.12			1
Silvereye (Grey-backed)	*Zosterops lateralis*	13	3	23.1	3	16		6	6.74			13
Southern Boobook	*Ninox novaeseelandiae*	4	1	25.0	1	5		3	3.37			4
Southern Whiteface	*Aphelocephala leucopsis*	46	25	54.3	57	103	2	24	26.97			48
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	2		0.0		2		2	2.25			2

English name	Binomial name	Banded IFRS	No. Recaptured IFRS	Percentage recaptured at IFRS	No. Times recaptured IFRS	Total no. of captures IFRS	Riverina banded excluding IFRS	Number of months birds banded between 1964 and 1972 in Riverina (n=89)	Percentage of months birds banded between 1964 and 1972 in Riverina (n=89)	Banded at nest or young Riverina excluding IFRS	Month or range of months found breeding	Total banded Riverina including IFRS
Spotted Pardalote	*Pardalotus punctatus*	4		0.0		4		3	3.37			4
Straw-necked Ibis	*Threskiornis spinicollis*						1173	1	1.12	1173	12	1173
Striated Pardalote	*Pardalotus striatus substriatus*	265	25	9.4	28	293		23	25.84			265
Striated Pardalote (Eastern)	*Pardalotus striatus ornatus*	6		0.0		6		4	4.49			6
Striated Pardalote (Yellow tipped)	*Pardalotus striatus striatus*	1		0.0		1		1	1.12			1
Striped Honeyeater	*Plectorhyncha lanceolata*	7	1	14.3	1	8		4	4.49			7
Stubble Quail	*Coturnix pectoralis*	11		0.0		11	185	6	6.74			196
Superb Parrot	*Polytelis swainsonii*	9		0.0		9		3	3.37			9
Tawny Frogmouth	*Podargus strigoides*	2		0.0		2	3	4	4.49			5
Tree Martin	*Petrochelidon nigricans*	11		0.0		11	1	5	5.62			12
Wedge-tailed Eagle	*Aquila audax*						2	1	1.12	2	7,10	2
Weebill	*Smicrornis brevirostris*	5		0.0		5		4	4.49			5
Welcome Swallow	*Hirundo neoxena*	76		0.0		76	5	19	21.35	5	10-12	81
Western Gerygone	*Gerygone fusca*	2		0.0		2		2	2.25			2
White-backed Swallow	*Cheramoeca leucosterna*	1		0.0		1	10	3	3.37	10	10	11
White-breasted Woodswallow	*Artamus leucorynchus*	1		0.0		1	2	2	2.25	2	9	3
White-faced Heron	*Egretta novaehollandiae*	1		0.0		1	1	1	1.12	1	11	2
White-fronted Chat	*Epthianura albifrons*	8		0.0		8	2	2	2.25	2	9	10
White-necked Heron	*Ardea pacifica*						17	1	1.12	17	10-1	17
White-plumed Honeyeater	*Lichenostomus penicillatus*	1271	331	26.0	486	1757	11	38	42.70			1282
White-throated Gerygone	*Gerygone albogularis*	1		0.0		1		1	1.12			1
White-winged Chough	*Corcorax melanorhamphos*	1		0.0		1	4	2	2.25	3	10	5
White-winged Triller	*Lalage sueurii*	22	1	4.5	1	23		7	7.87			22
Willie Wagtail	*Rhipidura leucophrys*	53	8	15.1	9	62	1	20	22.47			54
Yellow Thornbill	*Acanthiza nana*	26	6	23.1	7	33		13	14.61			26
Yellow-billed Spoonbill	*Platalea flavipes*						13	3	3.37	13	10-1	13
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	157	54	34.4	86	243	1	34	38.20			158
Yellow-throated Miner	*Manorina flavigula*	29		0.0		29		5	5.62			29
Zebra Finch	*Taeniopygia guttata*	30	3	10.0	3	33		2	2.25			30
	TOTALS	**3139**	**608**	**19.4**	**922**	**4061**	**2499**	**720**		**1980**	**35**	**5638**
Number of species		**95**	**39**		**39**	**97**	**67**	**107**		**36**	**36**	**118**

of times an individual bird is re-trapped declines as the number of recaptures increase (Fig.8 (a-f)), although *A. leucopsis*, *P. haematonotus* and *G. striata*, show slight anomalies with more being re-trapped more than once (Fig. 8d,e and f).

The days between banding and recapture, grouped into 50 day intervals are also plotted for the 5 most frequently recaptured species (Fig. 9a-e). Typically most recaptures were within the first 50 days and then numbers declined rapidly with time. Some species for example *Aphelocephala leucopsis* and Striated Pardalote *Pardalotus striatus substriatus* (Fig. 9c and d) showed an absence of recoveries for quite long periods. Capture rate of *Psephotus haematonotus* was influenced by a period of trapping with a drop net close to the mist net site B (Fig. 3). This increased the capture rate of this species, since they were more readily captured in a drop trap than in mist nets, especially when feeding on Paddy Melons *Cucumis myriocarpus*. This parrot was always abundant in the area.

Seasonality

The frequency of occurrence was demonstrated by numbers of each species captured (banded plus times re-trapped) in each season over the entire period (Table 2), and number of birds per day of netting (net/days) in each season (Table 3). The species occurring by season, for all years is shown also in Table 2 and 3. A selection of 17 species were plotted to show the numbers and numbers per net day for each season throughout the period (1965-1972) (Fig. 10 a-e for resident species and Fig. 11 a-l for irregular visitors). In addition 27 species were plotted to show the number of years that these species were recorded for each month and the annual presence between 1964 and 1972 (Fig. 12: 13 species which were resident at least in some years, Fig. 13 : 14 species that were seasonal or irregular visitors).

Influence of rainfall and river height (flooding) on bird presence.

Daily river heights and mean annual river heights of the Murrumbidgee River at Wagga Wagga upstream of the Research Station and monthly and mean annual rainfall at Narrandera for the period 1964 to 1972 (From Australian Government, Bureau of Meteorology 2008) are plotted so that comparisons could be made with the occurrence of birds at the Research Station over that period (Fig. 14). The data shows better than average floods in 1964, 1966 and 1970, while local rainfall was highest in 1966, 1969, 1970, and 1971. The wettest years over the 1964-1972 period, for the area were 1966 and 1970. The lowest mean annual rainfall was in 1967 followed by the lowest mean annual river height in 1968.

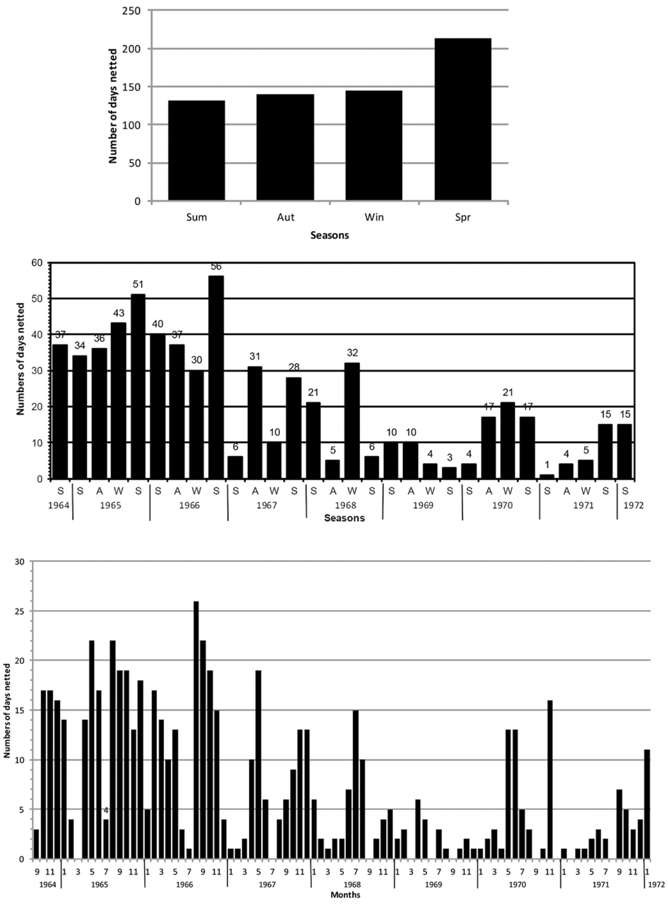


Fig. 5. Number of days netted by total for each season, by seasons and by months. (n=629)

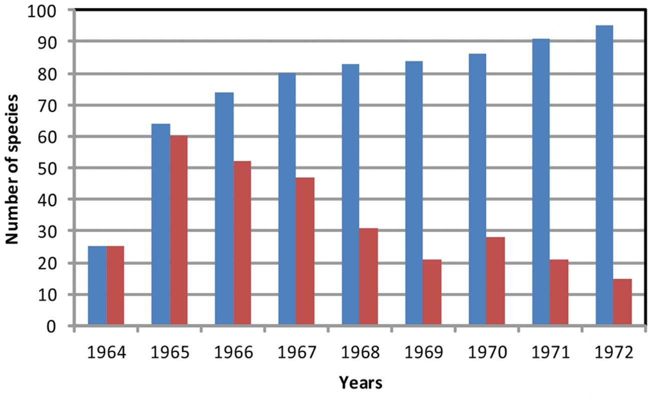


Fig. 6. Numbers of species of bird banded at IFRS between 1964 and 1972. Cumulative numbers (blue). Number of species banded each year (red).

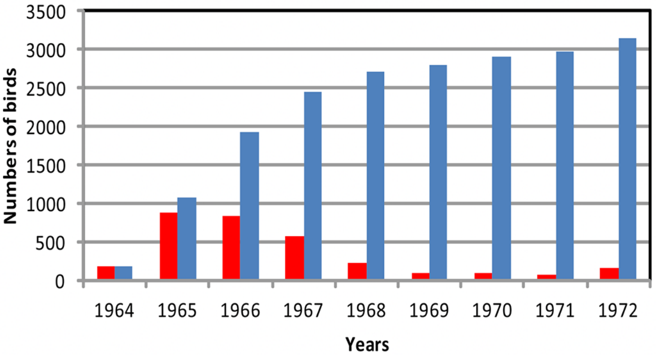


Fig. 7. Numbers of birds banded at IFRS between 1964 and 1972. Cumulative numbers (blue). Numbers banded each year (red).

Discussion

The recovery of banded birds showed an expected decline in the frequency of times recovered over time (Fig. 9) and a considerable decline in numbers captured as distance from the banding site increased, since virtually no returns were received outside the IFRS. However where more of a species were captured more than once particularly *Aphelocephala leucopsis* and *Geopelia striata* (Fig.8d,f), this could be explained by the species numbers in the area being stable with no immigration of other birds from outside; because once all of that species occurring in the area were banded, only already banded birds were trapped. *Psephotus haematonotus* also falls into this category (Fig. 8e), but the change in capture method using a drop trap over short periods would change the overall picture, if this form of trapping had been utilized continuously. Numerous species were not banded or recaptured over quite long periods in some cases many years (Fig. 13) suggesting they were absent from the banding area. Many of these fluctuations would be the result of environmental conditions at the time.

The 17 species plotted for seasonal abundance showed similar trends when plotted by numbers of birds per season and numbers per net day per season (Fig.10 and 11). Both *Acanthiza chrysorrhoa* and *Lichenostomus penicillatus* were present all year round (Fig.10d,e), (Fig. 12), while species such as *Cracticus tibicen tibicen*, *Platycercus elegans flaveolus*, House Sparrow *Passer domesticus*, *Aphelocephala leucopsis*, *Pardalotus striatus substriatus* and Willie Wagtail *Rhipidura leucophrys* were present in all seasons some years and absent in other years (Fig. 10,11,12). The Flame Robin *Petroica phoenicea* was clearly a winter visitor (Fig. 11,13), the Yellow-throated miner *Manorina flavigula* an Autumn/ Winter visitor (Fig. 11) and the Grey Fantail *Rhipidura*

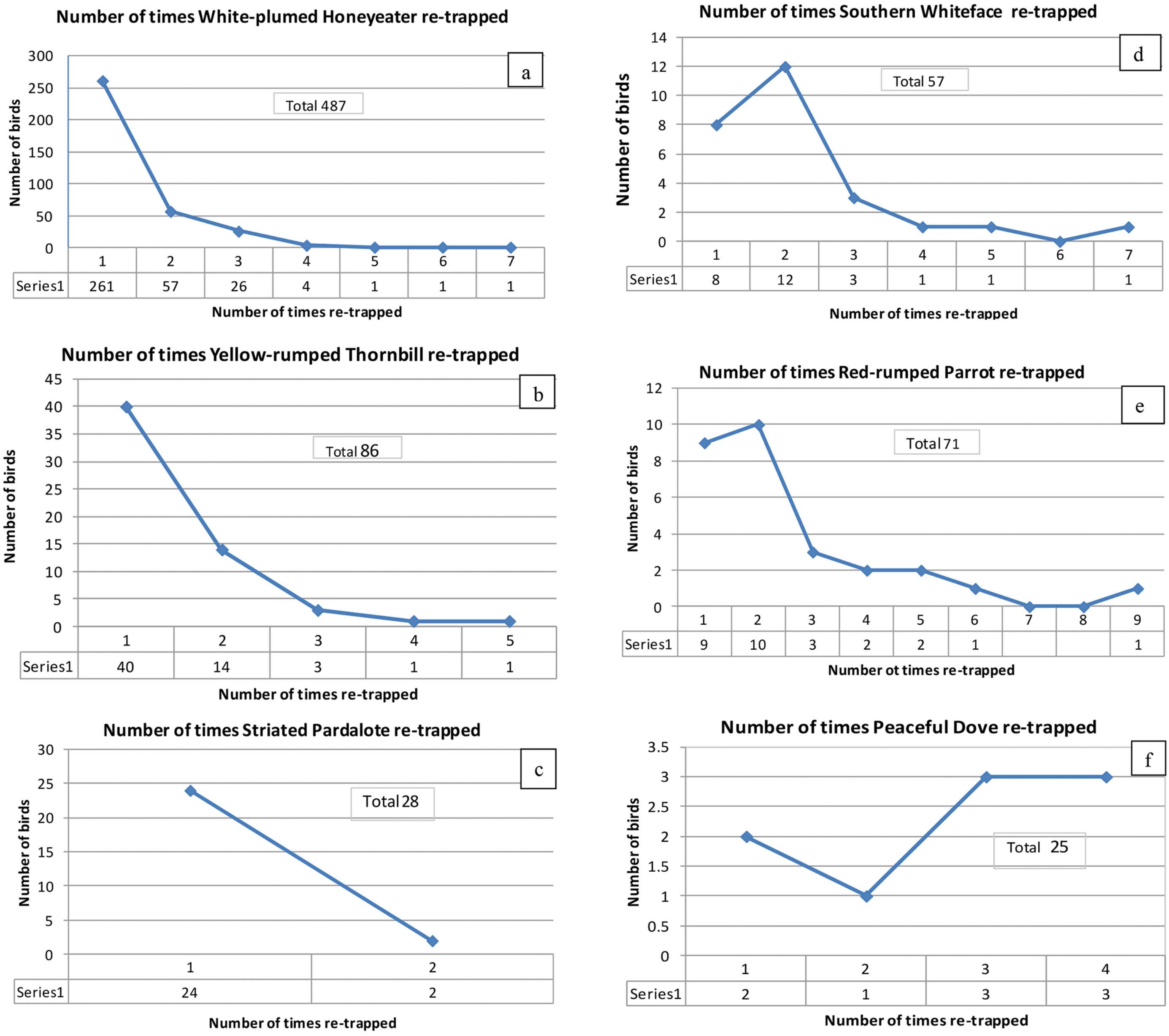


Fig. 8. The number of times individual birds were re-trapped a) White-plumed Honeyeater, b) Yellow-rumped Thornbill, c) Striated Pardalote. d) Southern Whiteface, e) Red-rumped Parrot, f) Peaceful Dove.

Table. 2. Total number of birds captured (banded plus times recaptured) for each season and each season combined from 1964 to 1972 at the IFRS. Summer is Dec. Jan. Feb.

YEAR	1964	1965				1966				1967				1968				1969				1970				1971				1972	Totals				
SEASON	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Au	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Tot Sum	Tot Aut	Tot Win	Tot Sp	Total
Australasian Grebe				1	4																										0	0	1	4	5
Australasian Pipit													1																		0	0	0	1	1
Australian Hobby			1																												0	1	0	0	1
Australian Magpie (Black-backed)	1		3	1	1	1		2					1	1		11		1					1	2			2				3	6	16	3	28
Australian Raven					1																										0	0	0	1	1
Australian Reed-Warbler					4	2												1			1								10	107	110	0	0	15	125
Australian White Ibis		2																													2	0	0	0	2
Australian Wood Duck																							1								0	1	0	0	1
Baillon's Crake																														4	4	0	0	0	4
Black-faced Cuckoo-shrike		1																													1	0	0	0	1
Black-fronted Dotterel														2																	2	0	0	0	2
Blue Bonnet																1															0	0	1	0	1
Blue-faced Honeteater									1				1			1															0	0	1	2	3
Brown Falcon																												1			0	0	1	0	1
Brown Goshawk																											1				0	1	0	0	1
Brown Treecreeper											1																				0	1	0	0	1
Brown-headed Honeyeater			3		2	9						5	3	1		1															10	3	6	5	24
Chestnut-rumped Thornbill	1					2										1							1								2	1	1	1	5
Cockatiel						1																									1	0	0	0	1
Common Blackbird				1																											0	0	1	0	1
Common Bronzewing						1																									1	0	0	0	1
Common Starling		6	1	1	9	1			2				11	16		2		1											5	21	45	1	3	27	76
Crested Pigeon		1			2	2				2			2					2	1												7	1	0	4	12

YEAR	1964	1965				1966				1967				1968				1969				1970				1971				1972	Totals				
SEASON	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Au	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Tot Sum	Tot Aut	Tot Win	Tot Sp	Total
Crested Shrike-tit					1	1																									1	0	0	1	2
Crimson Rosella (Yellow)	1		6	6		2	3		3	1	1	1	8	3		2			1				2								6	13	9	12	40
Diamond Firetail			11	5	1	1	11	1	1							1															1	22	7	2	32
Eastern Rosella	1		2		1				1				1	2		7															2	2	7	4	15
Eastern Yellow Robin																														1	1	0	0	0	1
European Goldfinch	1		26	13		8	10		4		1	2											1								8	38	15	5	66
Fairy Martin	3	1			3				1																1					3	4	0	0	8	12
Flame Robin				13							1					2								1							0	1	16	0	17
Galah						1							2																		1	0	0	2	3
Golden Whistler			4	1			3	1	1		1	1																			0	8	3	1	12
Grey Butcherbird			1																												0	1	0	0	1
Grey Fantail			1		4		2		7				1		1				1				2						1		0	7	0	13	20
Grey Shrike-thrush	3		2	1		2	4	2	1		2												1		2				1		2	9	3	7	21
Grey Teal																							5								0	5	0	0	5
Grey-crowned Babbler													3			3													1		0	0	3	4	7
Horsfield's Bronze-Cuckoo					1								1																		0	0	0	2	2
House Sparrow	5	10	14	5	13	33	10	7	2									1	2												44	26	12	20	102
Jacky Winter							3				1																				0	4	0	0	4
Latham's Snipe																														1	1	0	0	0	1
Laughing Kookaburra	1	2	2	1		3	3		2				3			2								2					2		5	5	5	8	23
Little Black Cormorant							1																								0	1	0	0	1
Little Button-quail																		2													2	0	0	0	2
Little Eagle																							1								0	1	0	0	1
Little Friarbird	3	4			8	10	3		10				14	2							7	1			41						17	3	0	83	103
Little Grassbird																													4	26	26	0	0	4	30
Little Raven													4																		0	0	0	4	4
Magpie-lark	1	1	3	2	5	7							1	1		3								1	1		1	2			9	4	8	8	29

YEAR	1964	1965				1966				1967				1968				1969				1970				1971				1972	Totals				
SEASON	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Au	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Tot Sum	Tot Aut	Tot Win	Tot Sp	Total
Masked Lapwing (Spur-winged Plover)					1								3																		0	0	0	4	4
Mistletoebird	2				1	1							1																		1	0	0	4	5
Musk Duck				1	1						1		1																		0	1	1	2	4
Nankeen Kestrel							1										1										3				0	4	0	1	5
Noisy Miner	2	1	33	2								1	19	3	4	8								1							4	37	12	21	74
Pacific Black Duck	1																							1						8	8	0	1	1	10
Peaceful Dove				1	1											34								4							0	0	39	1	40
Pied Butcherbird			1		3		2						2						1					2				1			0	4	3	5	12
Pied Currawong			1										1			3															0	1	3	1	5
Rainbow Bee-eater					1				1	1											1										1	0	0	3	4
Red-backed Kingfisher			1																												0	1	0	0	1
Red-capped Robin			3	1		5	4		5		7		7		1	7			3				2								5	20	8	12	45
Red-rumped Parrot	5	5	19	2	3	7	3	2		2		3	4	11		105							1								25	23	112	12	172
Restless Flycatcher	4		1						1																						0	1	0	5	6
Rufous Songlark																														1	1	0	0	0	1
Rufous Whistler			11	5	1	1	8	1	5		13	1	5			2			1		1		1		1				3		1	34	9	16	60
Sacred Kingfisher	1					1			2					1								1							1	4	7	0	0	4	11
Scarlet Robin							1																								0	1	0	0	1
Silvereye (Grey-backed)				4			2				2								8												0	12	4	0	16
Southern Boobook			1					2	1																					1	1	1	2	1	5
Southern Whiteface	32	8	9	5	17	6	2	1	10				7	1		4		1													16	11	10	66	103
Spiny-cheeked Honeyeater						1							1																		1	0	0	1	2
Spotted Pardalote			1	1			2																								0	3	1	0	4
Striated Pardalote	27	28	69	4	44	34	40		4		17	8	16						1					1							62	127	13	91	293
Striated Pardalote (Eastern)					3		2						1																		0	2	0	4	6

YEAR	1964	1965				1966				1967				1968				1969				1970				1971				1972	Totals				
SEASON	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Au	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Tot Sum	Tot Aut	Tot Win	Tot Sp	Total
Striated Pardalote (Yellow tipped)							1																								0	1	0	0	1
Striped Honeyeater			1								3	1	3																		0	4	1	3	8
Stubble Quail													6											5							0	0	5	6	11
Superb Parrot					3								4				2														0	0	0	9	9
Tawny Frogmouth														1	1																1	1	0	0	2
Tree Martin	3		1	1	1																				3					2	2	1	1	7	11
Weebill				1	2				2																						0	0	1	4	5
Welcome Swallow	33	1	6	1	16	6	2	2	3				1		1	1								1	2						7	9	5	55	76
Western Gerygone			1			1																									1	1	0	0	2
White-backed Swallow			1																												0	1	0	0	1
White-breasted Woodswallow												1																			0	0	1	0	1
White-faced Heron																													1		0	0	0	1	1
White-fronted Chat	4								4																						0	0	0	8	8
White-plumed Honeyeater	39	45	238	73	137	271	262	62	102	6	251	30	115	52	2	20			4		9		5	10	4				17	3	377	762	195	423	1757
White-throated Gerygone			1																												0	1	0	0	1
White-winged Chough																										1					1	0	0	0	1
White-winged Triller					6				3				10	2			1													1	3	0	0	20	23
Willie Wagtail	3	3	10	1	1	10	4	5		2	11	4	2						1				1				1		1	2	17	28	10	7	62
Yellow Thornbill				3		2			2		1	1	2	1	2	6			5					2					6		3	8	12	10	33
Yellow-rumped Thornbill	33	12	37	15	10	16	7	3	25	2	23	3	12	4	2	11	1		11				7	5					4		34	87	37	85	243
Yellow-throated Miner			20	3	1			5																							0	20	8	1	29
Zebra finch					2														28	1	1		1								0	29	1	3	33
TOTALS	210	131	546	175	315	449	396	96	206	16	337	62	280	104	14	238	5	9	68	1	20	2	33	38	55	1	8	4	57	185	897	1402	614	1148	4061

Table. 3. Total number of birds captured (banded plus times recaptured) per net day for each season and each season combined from 1964 to 1972 at the IFRS. Summer is Dec. Jan. Feb.

	1964	1965				1966				1967				1968				1969				1970				1971				1972	Sum Tot	Aut Tot	Win Tot	Sp Tot	No. birds capt..	No. days netted	No. cap/net day
	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum							
Australasian Grebe	–	–	–	0.02	0.08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	0.028	5	629	0.008
Australasian Pipit	–	–	–	–	–	–	–	–	–	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	1	629	0.002
Australian Hobby	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Australian Magpie (Black-backed)	0.03	–	0.08	0.02	0.02	0.03	–	0.07	–	–	–	–	0.04	0.05	–	0.34	–	0.10	–	–	–	–	0.06	0.10	–	–	0.50	–	–	–	0.014	0.046	0.114	0.021	28	629	0.045
Australian Raven	–	–	–	–	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	1	629	0.002
Australian Reed Warbler	–	–	–	–	0.08	0.05	–	–	–	–	–	–	–	–	–	–	–	0.10	–	–	0.33	–	–	–	–	–	–	–	0.67	7.13	0.516	–	–	0.103	125	629	0.199
Australian White Ibis	–	0.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.009	–	–	–	2	629	0.003
Australian Wood Duck	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.06	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Baillon's Crake	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.27	0.019	–	–	–	4	629	0.006
Black-faced Cuckoo-shrike	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	–	1	629	0.002
Black-fronted Dotterel	–	–	–	–	–	–	–	–	–	–	–	–	–	0.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.009	–	–	–	2	629	0.003
Blue Bonnet	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	–	1	629	0.002
Blue-faced Honeyeater	–	–	–	–	–	–	–	–	0.02	–	–	–	0.04	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	0.014	3	629	0.005
Brown Falcon	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.20	–	–	–	–	0.007	–	1	629	0.002
Brown Goshawk	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.25	–	–	–	–	0.008	–	–	1	629	0.002
Brown Treecreeper	–	–	–	–	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Brown-headed Honeyeater	–	–	0.08	–	0.04	0.23	–	–	–	–	–	0.50	0.11	0.05	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.047	0.023	0.043	0.034	24	629	0.038
Chestnut-rumped Thornbill	0.03	–	–	–	–	0.05	–	–	–	–	–	–	–	–	–	0.03	–	–	–	–	–	–	0.06	–	–	–	–	–	–	–	0.009	0.008	0.007	0.007	5	629	0.008
Cockatiel	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	–	1	629	0.002

	1964	1965				1966				1967				1968				1969				1970				1971				1972							
	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Sum Tot	Aut Tot	Win Tot	Sp Tot	No. birds capt..	No. days netted	No. cap/net day
Common Blackbird	–	–	–	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	–	1	629	0.002
Common Bronzewing	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	–	1	629	0.002
Common Starling	–	0.18	0.03	0.02	0.18	0.03	–	–	0.04	–	–	–	0.39	0.76	–	0.06	–	0.10	–	–	–	–	–	–	–	–	–	–	0.33	1.40	0.211	0.008	0.021	0.186	76	629	0.121
Crested Pigeon	–	0.03	–	–	0.04	0.05	–	–	–	0.33	–	–	0.07	–	–	–	–	0.20	0.10	–	–	–	–	–	–	–	–	–	–	–	0.033	0.008	–	0.028	12	629	0.019
Crested Shrike-tit	–	–	–	–	0.02	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	0.007	2	629	0.003
Crimson Rosella (Yellow)	0.03	–	0.17	0.14	–	0.05	0.08	–	0.05	0.17	0.03	0.10	0.29	0.14	–	0.06	–	–	0.10	–	–	–	0.12	–	–	–	–	–	–	–	0.028	0.099	0.064	0.083	40	629	0.064
Diamond Firetail	–	–	0.31	0.12	0.02	0.03	0.30	0.03	0.02	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	0.168	0.050	0.014	32	629	0.051
Eastern Rosella	0.03	–	0.06	–	0.02	–	–	–	0.02	–	–	–	0.04	0.10	–	0.22	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.009	0.015	0.050	0.028	15	629	0.024
Eastern Yellow Robin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.07	0.005	–	–	–	1	629	0.002
European Goldfinch	0.03	–	0.72	0.30	–	0.20	0.27	–	0.07	–	0.03	0.20	–	–	–	–	–	–	–	–	–	–	0.06	–	–	–	–	–	–	–	0.038	0.290	0.107	0.034	66	629	0.105
Fairy Martin	0.08	0.03	–	–	0.06	–	–	–	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.06	–	–	–	–	0.20	0.019	–	–	0.055	12	629	0.019
Flame Robin	–	–	–	0.30	–	–	–	–	–	–	0.03	–	–	–	–	0.06	–	–	–	–	–	–	–	0.05	–	–	–	–	–	–	–	0.008	0.114	–	17	629	0.027
Galah	–	–	–	–	–	0.03	–	–	–	–	–	–	0.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	0.014	3	629	0.005
Golden Whistler	–	–	0.11	0.02	–	–	0.08	0.03	0.02	–	0.03	0.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.061	0.021	0.007	12	629	0.019
Grey Butcherbird	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Grey Fantail	–	–	0.03	–	0.08	–	0.05	–	0.13	–	–	–	0.04	–	0.20	–	–	–	0.10	–	–	–	0.12	–	–	–	–	–	0.07	–	–	0.053	–	0.090	20	629	0.032
Grey Shrike-thrush	0.08	–	0.06	0.02	–	0.05	0.11	0.07	0.02	–	0.06	–	–	–	–	–	–	–	–	–	–	–	0.06	–	0.12	–	–	–	0.07	–	0.009	0.069	0.021	0.048	21	629	0.033
Grey Teal	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.29	–	–	–	–	–	–	–	–	0.038	–	–	5	629	0.008
Grey-crowned Babbler	–	–	–	–	–	–	–	–	–	–	–	–	0.11	–	–	0.09	–	–	–	–	–	–	–	–	–	–	–	–	0.07	–	–	–	0.021	0.028	7	629	0.011
Horsfield's Bronze-Cuckoo	–	–	–	–	0.02	–	–	–	–	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.014	2	629	0.003

	1964	1965				1966				1967				1968				1969				1970				1971				1972							
	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Sum Tot	Aut Tot	Win Tot	Sp Tot	No. birds capt..	No. days netted	No. cap/net day
House Sparrow	0.14	0.29	0.39	0.12	0.25	0.83	0.27	0.23	0.04	–	–	–	–	–	–	–	–	0.10	0.20	–	–	–	–	–	–	–	–	–	–	–	0.207	0.198	0.086	0.138	102	629	0.162
Jacky Winter	–	–	–	–	–	–	0.08	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.031	–	–	4	629	0.006
Latham's Snipe	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.07	0.005	–	–	–	1	629	0.002
Laughing Kookaburra	0.03	0.06	0.06	0.02	–	0.08	0.08	–	0.04	–	–	–	0.11	–	–	0.06	–	–	–	–	–	–	–	0.10	–	–	–	–	0.13	–	0.023	0.038	0.036	0.055	23	629	0.037
Little Black Cormorant	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Little Button-quail	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.20	–	–	–	–	–	–	–	–	–	–	–	–	0.009	–	–	–	2	629	0.003
Little Eagle	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.06	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Little Friarbird	0.08	0.12	–	–	0.16	0.25	0.08	–	0.18	–	–	–	0.50	0.10	–	–	–	–	–	–	2.33	0.25	–	–	2.41	–	–	–	–	–	0.080	0.023	–	0.572	103	629	0.164
Little Grassbird	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.27	1.73	0.122	–	–	0.028	30	629	0.048
Little Raven	–	–	–	–	–	–	–	–	–	–	–	–	0.14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.028	4	629	0.006
Magpie-lark	0.03	0.03	0.08	0.05	0.10	0.18	–	–	–	–	–	–	0.04	0.05	–	0.09	–	–	–	–	–	–	–	0.05	0.06	–	0.25	0.40	–	–	0.042	0.031	0.057	0.055	29	629	0.046
Masked Lapwing (Spur-winged Plover)	–	–	–	–	0.02	–	–	–	–	–	–	–	0.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.028	4	629	0.006
Mistletoebird	0.05	–	–	–	0.02	0.03	–	–	–	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	0.028	5	629	0.008
Musk Duck	–	–	–	0.02	0.02	–	–	–	–	–	0.03	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	0.007	0.014	4	629	0.006
Nankeen Kestrel	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	0.17	–	–	–	–	–	–	–	–	–	0.75	–	–	–	–	0.031	–	0.007	5	629	0.008
Noisy Miner	0.05	0.03	0.92	0.05	–	–	–	–	–	–	–	0.10	0.68	0.14	0.80	0.25	–	–	–	–	–	–	–	0.05	–	–	–	–	–	–	0.019	0.282	0.086	0.145	74	629	0.118
Pacific Black Duck	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.05	–	–	–	–	–	0.53	0.038	–	0.007	0.007	10	629	0.016
Peaceful Dove	–	–	–	0.02	0.02	–	–	–	–	–	–	–	–	–	–	1.06	–	–	–	–	–	–	–	0.19	–	–	–	–	–	–	–	–	0.279	0.007	40	629	0.064
Pied Butcherbird	–	–	0.03	–	0.06	–	0.05	–	–	–	–	–	0.07	–	–	–	–	–	0.10	–	–	–	–	0.10	–	–	–	0.20	–	–	–	0.031	0.021	0.034	12	629	0.019
Pied Currawong	–	–	0.03	–	–	–	–	–	–	–	–	–	0.04	–	–	0.09	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	0.021	0.007	5	629	0.008
Rainbow Bee-eater	–	–	–	–	0.02	–	–	–	0.02	0.17	–	–	–	–	–	–	–	–	–	–	0.33	–	–	–	–	–	–	–	–	–	0.005	–	–	0.021	4	629	0.006
Red-backed Kingfisher	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002

	1964	1965				1966				1967				1968				1969				1970				1971				1972							
	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Sum Tot	Aut Tot	Win Tot	Sp Tot	No. birds capt..	No. days netted	No. cap/net day
Red-capped Robin	–	–	0.08	0.02	–	0.13	0.11	–	0.09	–	0.23	–	0.25	–	0.20	0.22	–	–	0.30	–	–	–	0.12	–	–	–	–	–	–	–	0.023	0.153	0.057	0.083	45	629	0.072
Red-rumped Parrot	0.14	0.15	0.53	0.05	0.06	0.18	0.08	0.07	–	0.33	–	0.30	0.14	0.52	–	3.28	–	–	–	–	–	–	0.06	–	–	–	–	–	–	–	0.117	0.176	0.800	0.083	172	629	0.273
Restless Flycatcher	0.11	–	0.03	–	–	–	–	–	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	0.034	6	629	0.010
Rufous Songlark	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.07	0.005	–	–	–	1	629	0.002
Rufous Whistler	–	–	0.31	0.12	0.02	0.03	0.22	0.03	0.09	–	0.42	0.10	0.18	–	–	0.06	–	–	0.10	–	0.33	–	0.06	–	0.06	–	–	–	0.20	–	0.005	0.260	0.064	0.110	60	629	0.095
Sacred Kingfisher	0.03	–	–	–	–	0.03	–	–	0.04	–	–	–	–	0.05	–	–	–	–	–	–	–	0.25	–	–	–	–	–	–	0.07	0.27	0.033	–	–	0.028	11	629	0.017
Scarlet Robin	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Silvereye (Grey-backed)	–	–	–	0.09	–	–	0.05	–	–	–	0.06	–	–	–	–	–	–	–	0.80	–	–	–	–	–	–	–	–	–	–	–	–	0.092	0.029	–	16	629	0.025
Southern Boobook	–	–	0.03	–	–	–	–	0.07	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.07	0.005	0.008	0.014	0.007	5	629	0.008
Southern Whiteface	0.86	0.24	0.25	0.12	0.33	0.15	0.05	0.03	0.18	–	–	–	0.25	0.05	–	0.13	–	0.10	–	–	–	–	–	–	–	–	–	–	–	–	0.075	0.084	0.071	0.455	103	629	0.164
Spiny-cheeked Honeyeater	–	–	–	–	–	0.03	–	–	–	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	–	–	0.007	2	629	0.003
Spotted Pardalote	–	–	0.03	0.02	–	–	0.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.023	0.007	–	4	629	0.006
Striated Pardalote	0.73	0.82	1.92	0.09	0.86	0.85	1.08	–	0.07	–	0.55	0.80	0.57	–	–	–	–	–	0.10	–	–	–	–	0.05	–	–	–	–	–	–	0.291	0.969	0.093	0.628	293	629	0.466
Striated Pardalote (Eastern)	–	–	–	–	0.06	–	0.05	–	–	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.015	–	0.028	6	629	0.010
Striated Pardalote (Yellow tipped)	–	–	–	–	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
Striped Honeyeater	–	–	0.03	–	–	–	–	–	–	–	0.10	0.10	0.11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.031	0.007	0.021	8	629	0.013
Stubble Quail	–	–	–	–	–	–	–	–	–	–	–	–	0.21	–	–	–	–	–	–	–	–	–	–	0.24	–	–	–	–	–	–	–	–	0.036	0.041	11	629	0.017
Superb Parrot	–	–	–	–	0.06	–	–	–	–	–	–	–	0.14	–	–	–	0.33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.062	9	629	0.014
Tawny Frogmouth	–	–	–	–	–	–	–	–	–	–	–	–	–	0.05	0.20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	0.008	–	–	2	629	0.003
Tree Martin	0.08	–	0.03	0.02	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.18	–	–	–	–	0.13	0.009	0.008	0.007	0.048	11	629	0.017

	1964	1965				1966				1967				1968				1969				1970				1971				1972	Sum Tot	Aut Tot	Win Tot	Sp Tot	No. birds capt..	No. days netted	No. cap/net day
	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum	Aut	Win	Sp	Sum							
Weebill	–	–	–	0.02	0.04	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	0.028	5	629	0.008
Welcome Swallow	0.89	0.03	0.17	0.02	0.31	0.15	0.05	0.07	0.05	–	–	–	0.04	–	0.20	0.03	–	–	–	–	–	–	–	0.05	0.12	–	–	–	–	–	0.033	0.069	0.036	0.379	76	629	0.121
Western Gerygone	–	–	0.03	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.005	0.008	–	–	2	629	0.003
White-backed Swallow	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
White-breasted Woodswallow	–	–	–	–	–	–	–	–	–	–	–	0.10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.007	–	1	629	0.002
White-faced Heron	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.07	–	–	–	–	0.007	1	629	0.002
White-fronted Chat	0.11	–	–	–	–	–	–	–	0.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.055	8	629	0.013
White-plumed Honeyeater	1.05	1.32	6.61	1.70	2.69	6.78	7.08	2.07	1.82	1.00	8.10	3.00	4.11	2.48	0.40	0.63	–	–	0.40	–	3.00	–	0.29	0.48	0.24	–	–	–	1.13	0.20	1.770	5.817	1.393	2.917	1757	629	2.793
White-throated Gerygone	–	–	0.03	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	1	629	0.002
White-winged Chough	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.00	–	–	–	–	0.005	–	–	–	1	629	0.002
White-winged Triller	–	–	–	–	0.12	–	–	–	0.05	–	–	–	0.36	0.10	–	–	0.17	–	–	–	–	–	–	–	–	–	–	–	–	0.07	0.014	–	–	0.138	23	629	0.037
Willie Wagtail	0.08	0.09	0.28	0.02	0.02	0.25	0.11	0.17	–	0.33	0.35	0.40	0.07	–	–	–	–	–	0.10	–	–	–	0.06	–	–	–	0.25	–	0.07	0.13	0.080	0.214	0.071	0.048	62	629	0.099
Yellow Thornbill	–	–	–	0.07	–	0.05	–	–	0.04	–	0.03	0.10	0.07	0.05	0.40	0.19	–	–	0.50	–	–	–	–	0.10	–	–	–	–	0.40	–	0.014	0.061	0.086	0.069	33	629	0.052
Yellow-rumped Thornbill	0.89	0.35	1.03	0.35	0.20	0.40	0.19	0.10	0.45	0.33	0.74	0.30	0.43	0.19	0.40	0.34	0.17	–	1.10	–	–	–	0.41	0.24	–	–	–	–	0.27	–	0.160	0.664	0.264	0.586	243	629	0.386
Yellow-throated Miner	–	–	0.56	0.07	0.02	–	–	0.17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.153	0.057	0.007	29	629	0.046
Zebra finch	–	–	–	–	0.04	–	–	–	–	–	–	–	–	–	–	–	–	–	2.80	0.25	0.33	–	0.06	–	–	–	–	–	–	–	–	0.221	0.007	0.021	33	629	0.052
Number of days netted	37	34	36	43	51	40	37	30	56	6	31	10	28	21	5	32	6	10	10	4	3	4	17	21	17	1	4	5	15	15	213	131	140	145		629	
Total number of captures	210	131	546	175	315	449	396	96	206	16	337	62	280	104	14	238	5	9	68	1	20	2	33	38	55	1	8	4	57	185	1148	897	1402	614	4061		
Number of captures per net day	**5.68**	**3.85**	**15.17**	**4.07**	**6.18**	**11.23**	**10.70**	**3.20**	**3.68**	**2.67**	**10.87**	**6.20**	**10.00**	**4.95**	**2.80**	**7.44**	**0.83**	**0.90**	**6.80**	**0.25**	**6.67**	**0.50**	**1.94**	**1.81**	**3.24**	**1.00**	**2.00**	**0.80**	**3.80**	**12.33**	**5.39**	**6.85**	**10.01**	**4.00**			**6.456**

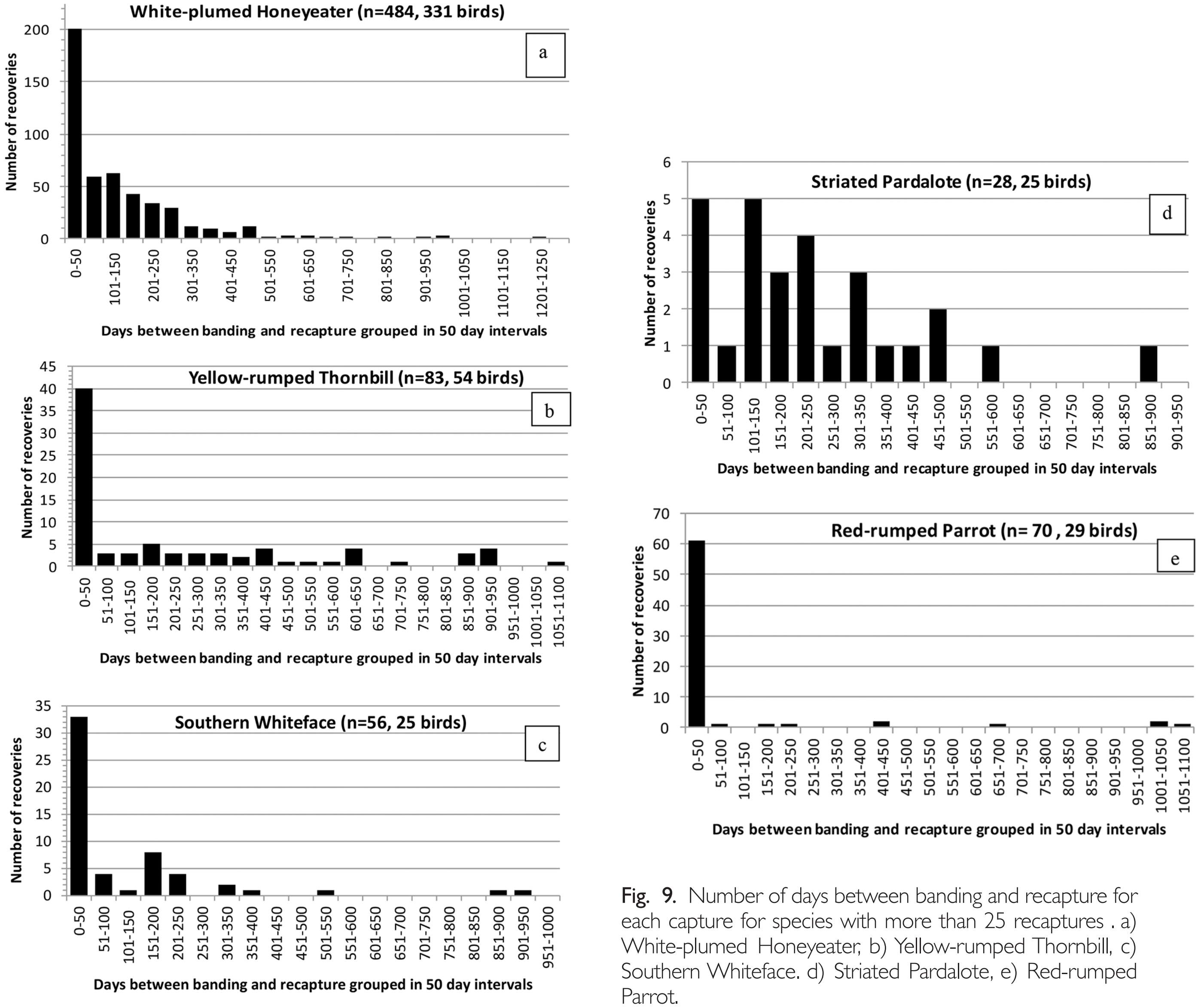


Fig. 9. Number of days between banding and recapture for each capture for species with more than 25 recaptures . a) White-plumed Honeyeater, b) Yellow-rumped Thornbill, c) Southern Whiteface. d) Striated Pardalote, e) Red-rumped Parrot.

albiscapa (fuliginosa) a spring /autumn visitor to the area (Fig. 10). The Mistletoebird *Dicaeum hirundinaceum*, *Merops ornatus* and White-winged Triller *Lalage sueurii* were only recorded in spring and early summer (Oct, Nov. Dec) (Fig. 13). *Petrochelidon ariel*, Little Friarbird *Philemon citreogularis* and Sacred Kingfisher *Todiramphus sanctus* were not captured during the winter periods April to August (Fig. 13). The Golden Whistler *Pachycephala pectoralis* was an autumn, and the Weebill *Smicrornis brevirostris* was a spring visitor (Fig. 13).

For the 27 species plotted (Fig. 12 and 13) three distinct patterns were evident: species resident all year around (Fig. 12) and seasonal visitors, irregular spasmodic visitors and some a combination of these (Fig. 13). *Lichenostomus penicillatus* and *Acanthiza chrysorrhoa* were recorded in all months, and *Cracticus tibicen tibicen*, *Platycercus elegans flaveolus*, *Passer domesticus*, Magpie Lark *Grallina cyanoleuca*, Red-capped Robin *Petroica goodenovii*, *Psephotus haematonotus*, Welcome Swallow *Hirundo neoxena*, *Rhipidura leucophrys*, and Yellow Thornbill *Acanthiza nana* were recorded in most months (Fig. 12). All 14 species shown in Figure 13 were recorded on irregular years. However, *Petrochelidon ariel*, *Philemon citreogularis*, *Todiramphus sanctus* and *Lalage sueurii* were spring/summer visitors. Although Australian Reed Warbler *Acrocephalus australis* and Little Grassbird *Megalurus gramineus* data suggests they were a spring summer visitor they were only common following the creation of a swamp close to the Research Station.

Rainfall in the Narrandera area and flooding from high river levels are not necessarily synchronous, because flooding could be caused from rains in the head-waters. Nevertheless both have a significant effect on the floral communities of the area, flooding particularly on riparian communities (see Fig.15) and rainfall on all communities. These conditions generally stimulate growth and flowering of plants and this attracts birds to the area and the flooding also causes a bloom in aquatic invertebrates and fish populations providing food for waterbirds and their ultimate breeding. Within the arid interior of the country, Nix (1976) forecast that ‘bird movement would be essentially random (in response to episodic rainfalls) but with an underlying north–south bias which reflects the action of tropical and temperate weather systems at

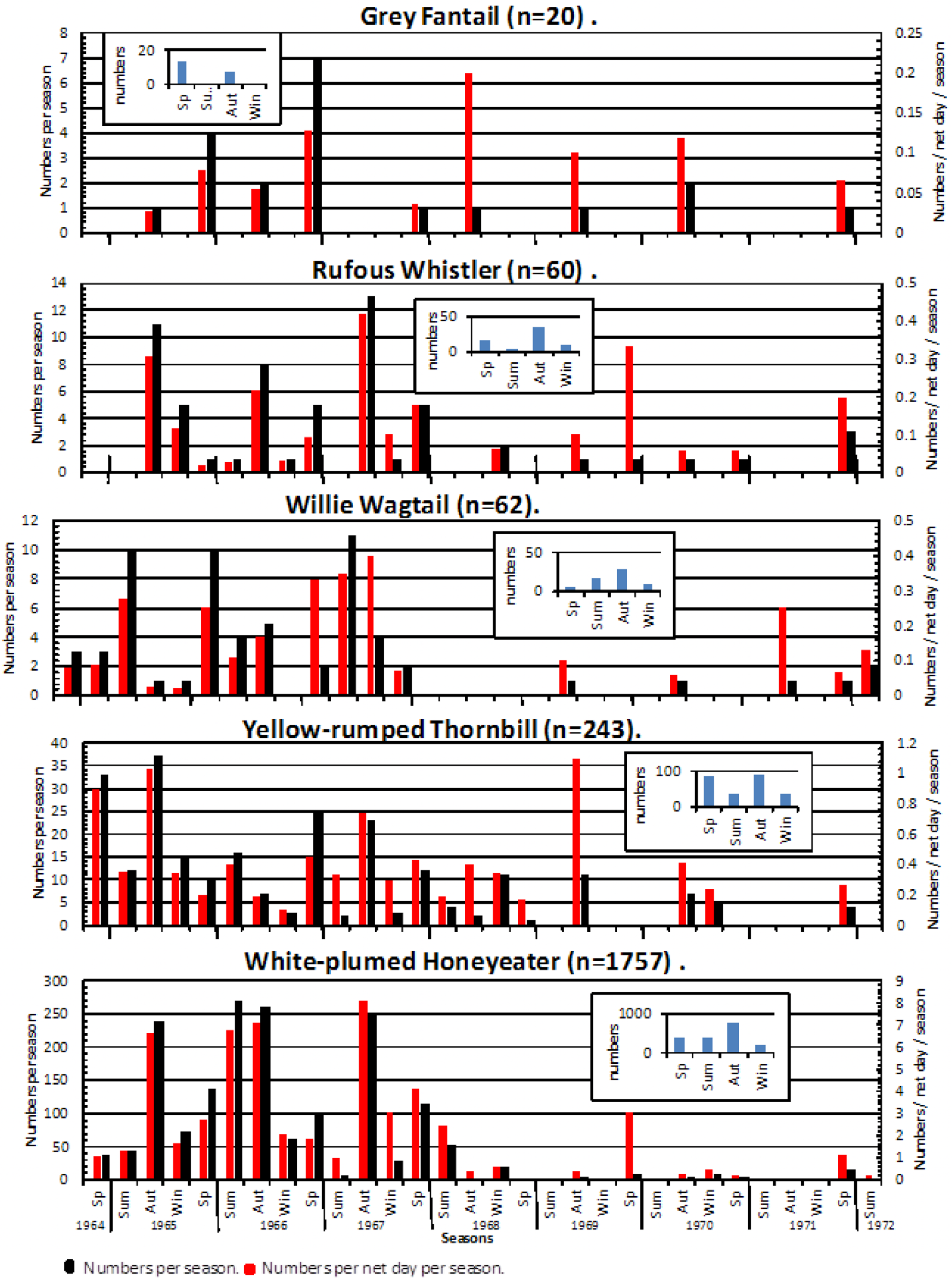
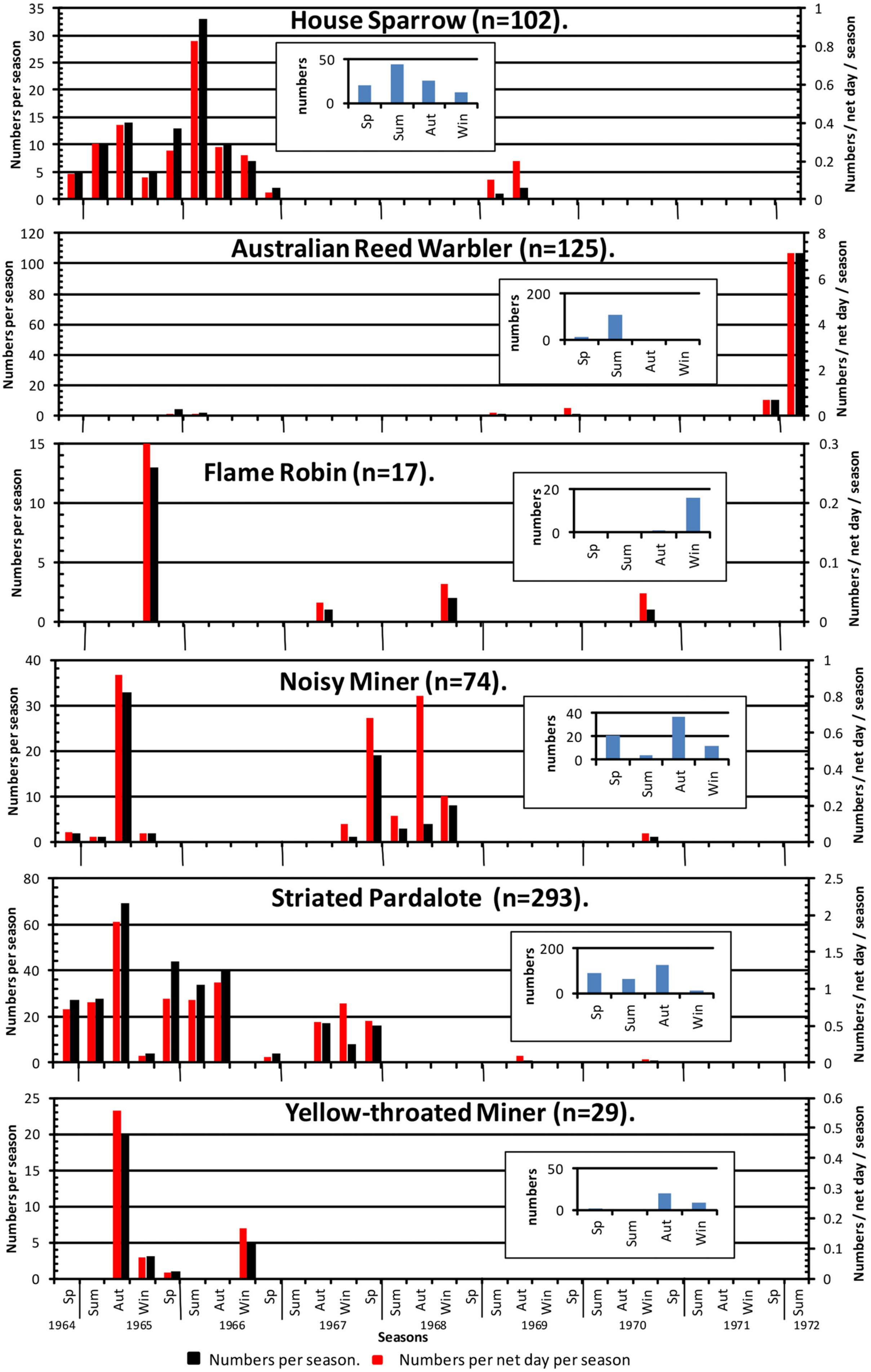


Fig. 10. Numbers caught per season and per net day per season for resident species, and inset numbers caught for each season grouped together. a) Grey Fantail, b) Rufous Whistler, c) Willie Wagtail, d) Yellow-rumped Thornbill, e) White-plumed Honeyeater.


House Sparrow (n=102).
Australian Reed Warbler (n=125).
Flame Robin (n=17).
Noisy Miner (n=74).
Striated Pardalote (n=293).
Yellow-throated Miner (n=29).
Numbers per season
Numbers / net day / season
numbers
Sp
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1965
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■ Numbers per season.
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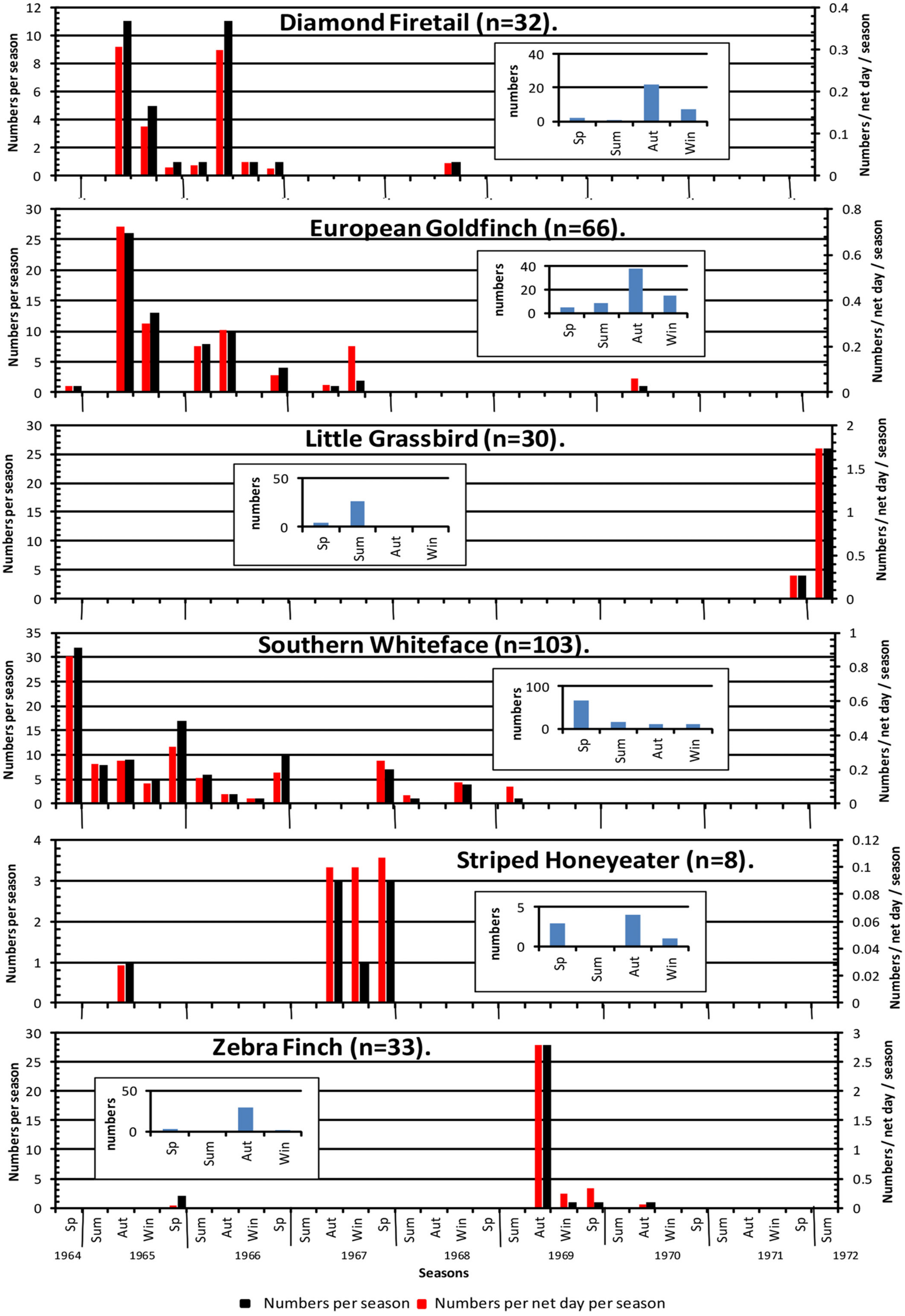

Fig. 11. Numbers caught per season and per net day per season for irregular visitors, and inset numbers caught for each season grouped together. a) House Sparrow, b) Australian Reed Warbler, c) Flame Robin, d) Noisy Miner, e) Striated Pardalote, f) Yellow-throated Miner, g) Diamond Firetail, h) European Goldfinch, i) Little Grassbird, j) Southern Whiteface, k) Striped Honeyeater, l) Zebra Finch.

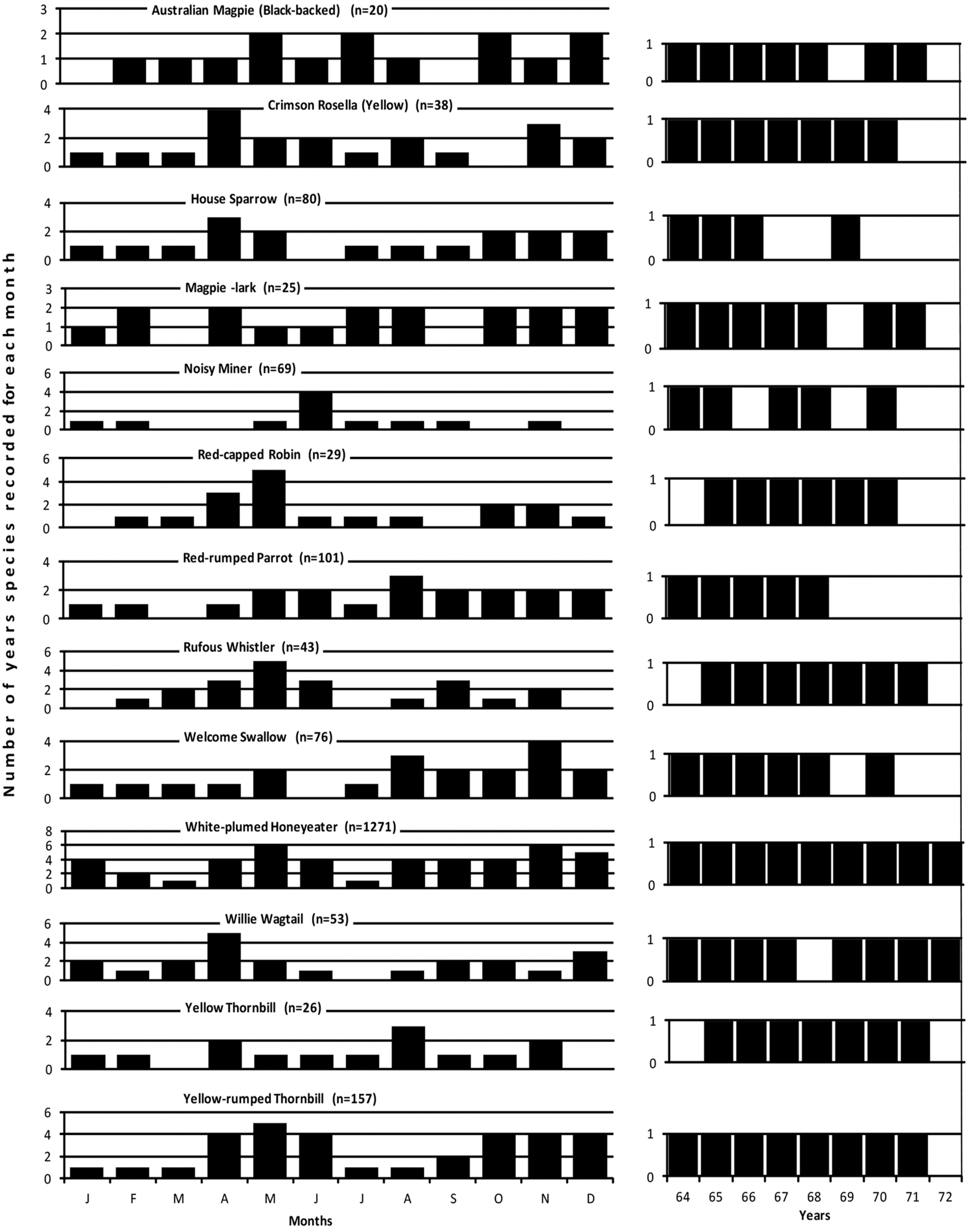

Fig. 12. Number of years species recorded for each month (total of 89 months) and annual presence between 1964 and 1972, demonstrating resident species for years when present. Australian Magpie (black-backed), Crimson Rosella (Yellow), House Sparrow, Magpie-lark, Noisy Miner, Red-capped Robin, Red-rumped Parrot, Rufous Whistler, Welcome Swallow, White-plumed Honeyeater, Willie Wagtail, Yellow Thornbill, Yellow-rumped Thornbill. n=total number of birds in sample.

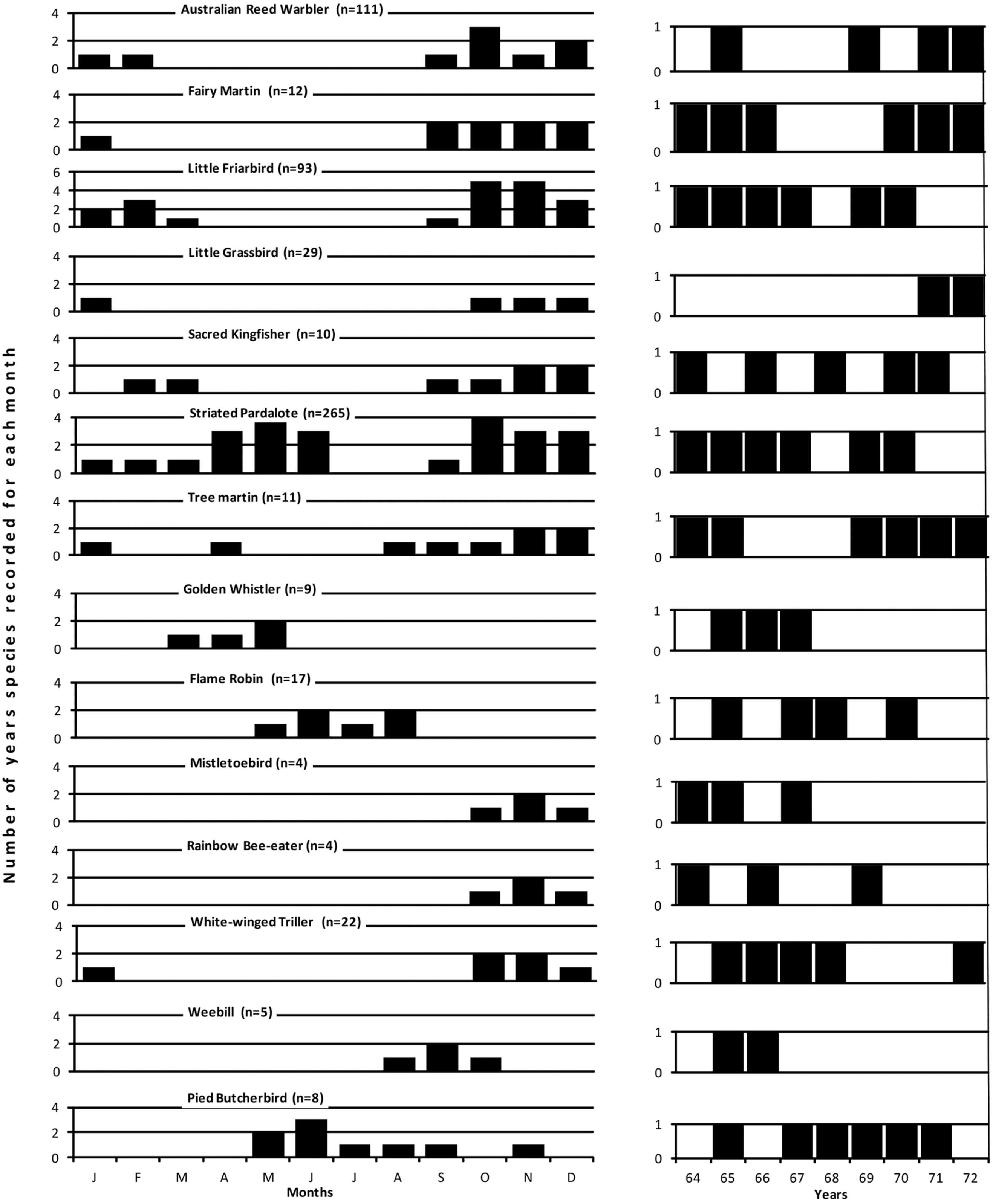

Fig. 13. Number of years species recorded for each month (total of 89 months) and annual presence between 1964 and 1972, demonstrating seasonal and irregular visitors for years when present. Australian Reed Warbler, Fairy Martin, Little Friarbird, Little Grassbird, Sacred Kingfisher, Striated Pardalote, Tree Martin, Golden Whistler, Flame Robin, Mistletoebird, Rainbow Bee-eater, White-winged Triller, Weebill, Pied Butcherbird. n=total number of birds in sample.

opposing seasons. Griffieon (2001) and Griffioen *et al*.. (2002) outlined the large scale movement patterns evident in eastern Australian birds demonstrated in the Australian atlas data. Barrett and Silcocks (2002) in comparing the first and second atlas of Australian birds 1977 – 1981 and 1998 – 2001 found that the *Threskiornis molucca*, Australasian Grebe *Tachybaptus novaehollandiae*, *Accipiter fasciatus, Dicaeum hirundinaceum, Aphelocephala leucopsis*

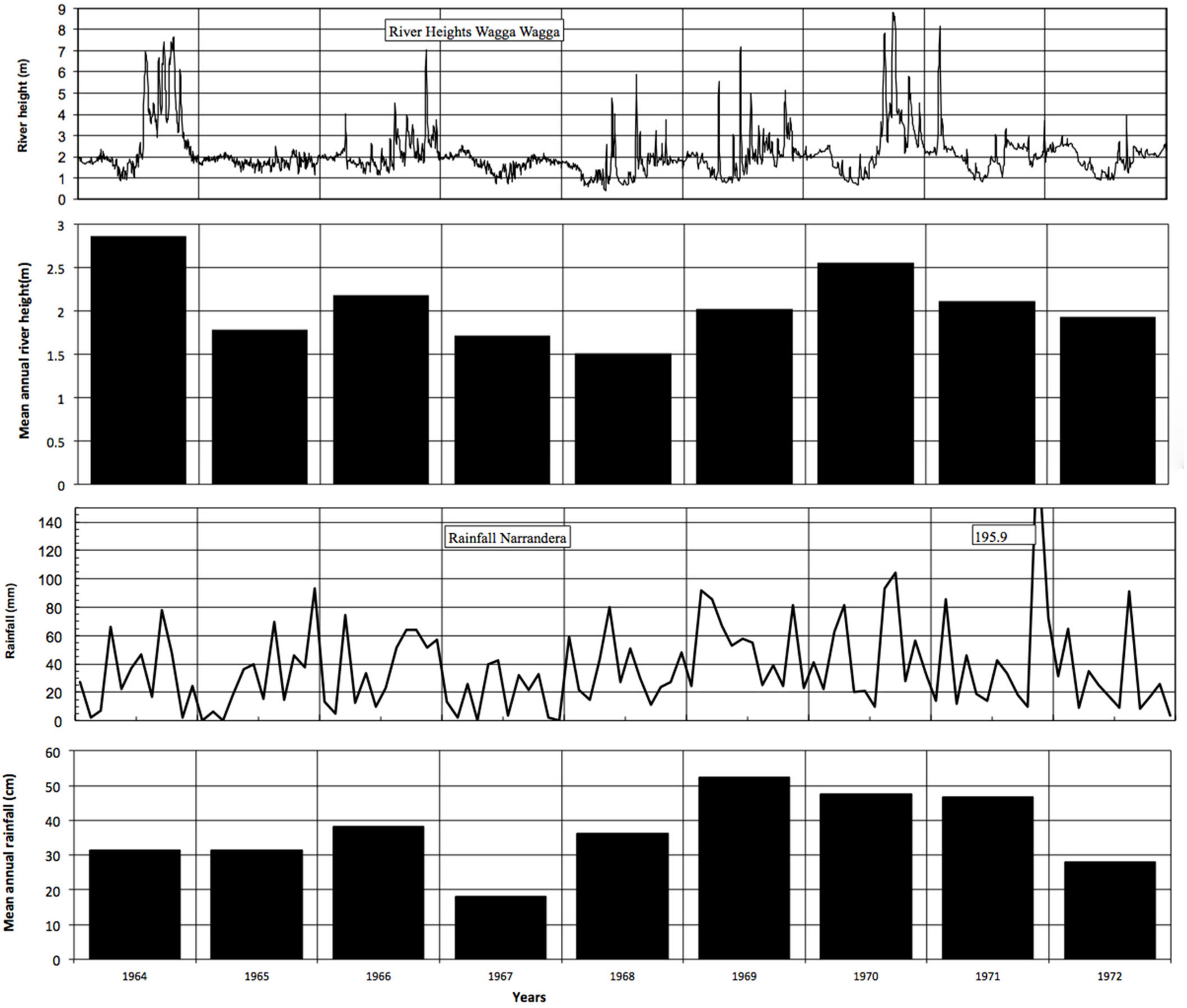

Fig. 14. Daily and mean annual river height in metres (top) at Wagga Wagga upstream of Narrandera on the Murrumbidgee River in eastern Riverina between 1964 and 1972. Monthly and mean annual rainfall (bottom) at Narrandera between 1964 and 1972.

and *Todiramphus sancta* showed increased reporting rates in the northern part of NSW where rainfall had increased over the last 20 years. Barrett *et al.*. (2007) also indicated that Atlas comparisons indicated that bioregions with greater rainfall had increased reporting rates and greater woodland bird diversity.

Gibbs *et al.*. (2011) from close examination of 16 species also suggested that annual fluctuations in rainfall can have dramatic and immediate effects on breeding, even for largely sedentary, seasonally breeding species.

In this study of note is the fact that *Passer domesticus*, *Petrochelidon ariel*, Tree Martin *Petrochelidon nigricans*, *Merops ornatus*, *Manorina flavigula*, Zebra Finch *Taeniopygia guttata* and *Smicrornis brevirostris* were not captured during the driest years (Fig. 11,12,13). *Acrocephalus australis* and *Megalurus gramineus* also were not present during these dry years, but this was influenced by the establishment of the swamp opposite the Research Station in 1969/1970. The wetter years seemed to increase numbers of *Passer domesticus*, Diamond Firetails *Stagonopleura guttata* and European Goldfinches *Carduelis carduelis*. Rainfall as opposed to flooding also appeared to have some affect on the presence of Striped Honeyeater *Plectorhyncha lanceolata*, *Pachycephala rufiventris* and *Rhipidura leucophrys* which were present or in highest numbers in 1967 the lowest rainfall year (Fig. 10, 11).

On examining the occurrence of species and their breeding, some which are normally non-resident but annual visitors, do not visit the area in really dry years eg. *Merops ornatus.* Conversely in around 1970 a swamp started to develop opposite the Research Station as a result of overflow from the outflow channel from the Research Station. This created excellent swamp habitat comprising dense stands of *Typha* sp. Cumbungi and *Phragmites* sp. Canegrass, which shortly after this supported numerous species such as *Acrocephalus australis*, Baillon's Crake *Porzana pusilla* and the Latham's Snipe *Gallinago hardwickii* hitherto

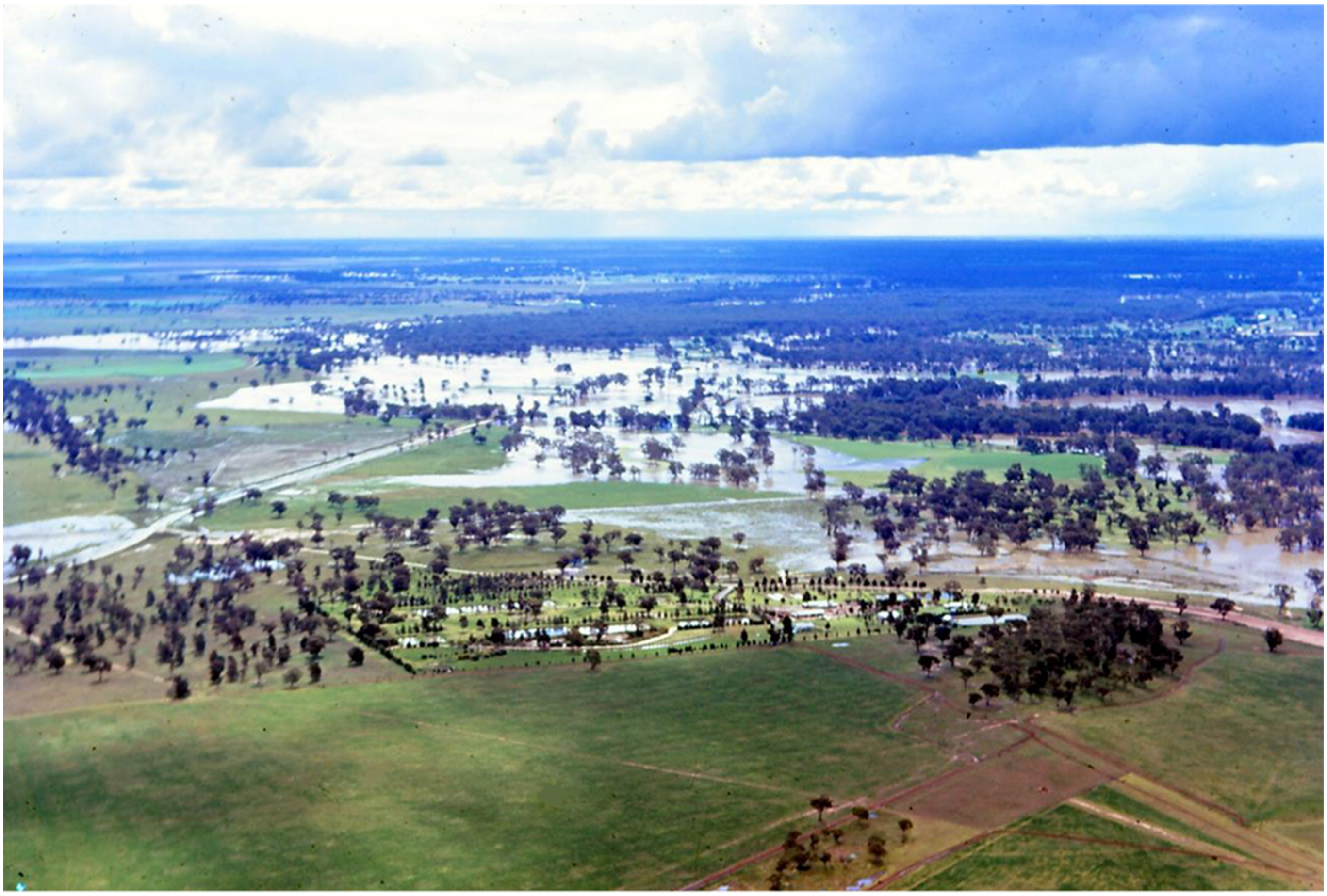

Fig. 15 Showing extent of flooding on Murrumbidgee flood plain June 1969 Inland Fisheries Research Station in centre picture and Narrandera in the far top right.

scarce or unrecorded at the Research Station site over the previous 5 years. Artificial floods resulting from pumping into a wetland to produce fodder for cattle at Dixon's Dam also initiated movement of birds into the area and ultimate breeding of numerous wetland species (Llewellyn 1983), (*Microcarbo melanoleucos*, *Phalacrocorax sulcirostris*, *Anhinga novaehollandiae*, White-faced Heron *Egretta novaehollandiae, Platalea flavipes*, *Ardea pacifica*, *Threskiornis molucca*, *Cygnus atratus*)

This study clearly shows the inappropriateness of carrying out studies over a short period of a couple of years and using this as a true representation of the population diversity of an area such as Narrandera. Such short term studies would only provide a proportion of the species diversity in the area. The cumulative plot of species (Fig. 6) shows an increase in numbers from 25 to 95 between1964 and 1972 demonstrating how the numbers of species recorded in an area increases over the time of observations.

The driving force behind distribution appears to be seasonality (temperature), and the long term drought and wet cycles that may be over five to fifteen years. Even the seven year study here is inadequate to cover the whole variation in environmental patterns and species diversity in an area. The environmental conditions throughout Australia can affect the pattern of occurrence of birds in any one locality like Narrandera. Examples are heavy rains in the highlands can cause floods in the lowlands without any rains in the lowlands, yet this can cause a significant influx of waterbirds to these flooded areas and initiate movement of birds into these areas and ultimate breeding. In this study the effect of a newly established swamp encouraged numerous species previously not recorded at the Research Station site to colonise the area. A further example is the huge populations of water birds that accumulate on Lake Eyre when it fills at very erratic periods of up to thirty years or more, and the exodus from these areas when breeding ceases and the change in population distribution of these species this exodus causes in areas much further afield such as in Narrandera. This ability of populations to shrink and expand over very large distances in response to climatic conditions is a key factor in their survival in the often very harsh Australian environment.

Acknowledgements

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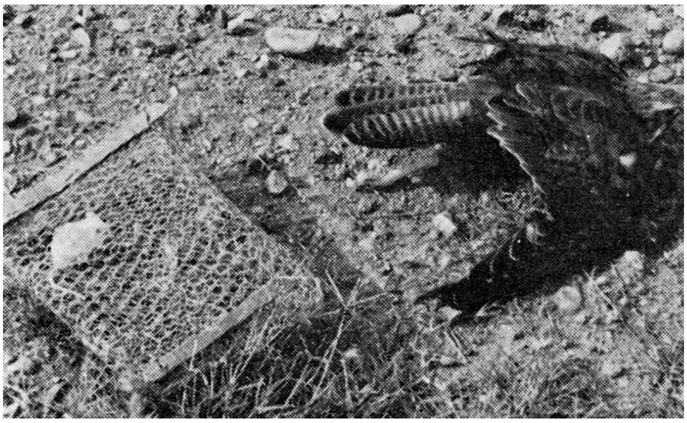
APPENDIX I



Brown Falcon caught in a Bal-chatri trap using a white mouse (L. Llewellyn).

Yellow-throated Miner caught in a mist net. (L. Llewellyn).

APPENDIX I

Male Plains-wanderer, an endangered species in NSW. (L. Llewellyn).

Female Plains-wanderer, an endangered species in NSW caught spot lighting at Morundah. (L. Llewellyn).

White-plumed Honeyeater (L. Llewellyn).

APPENDIX I

Pied Butcherbird (L. Llewellyn).

Tree Martin (L. Llewellyn).

APPENDIX I

Fairy Martin (L. Llewellyn).

Blue-faced Honeyeater (L. Llewellyn).

Spiny-cheeked Honeyeater (L. Llewellyn).

APPENDIX I

Rainbow Bee-eater (L. Llewellyn).

Noisy Miner (L. Llewellyn).

Yellow-throated Miner (L. Llewellyn).

Grey-crowned Babbler (L. Llewellyn).

APPENDIX I

Flame Robin (L. Llewellyn).

Sacred Kingfisher (L. Llewellyn).

Laughing Kookaburra (L. Llewellyn).

Tawny Frogmouth (L. Llewellyn).

Mistletoebird (L. Llewellyn).

APPENDIX I

Southern Boobook (L. Llewellyn).

Australian Hobby (L. Llewellyn).

Blue Bonnet (L. Llewellyn).

APPENDIX I

Cockatiel (L. Llewellyn).

Crimson Rosella (Yellow) (L. Llewellyn).

Red-kneed Dotterel (L. Llewellyn).

Latham's Snipe (L. Llewellyn).